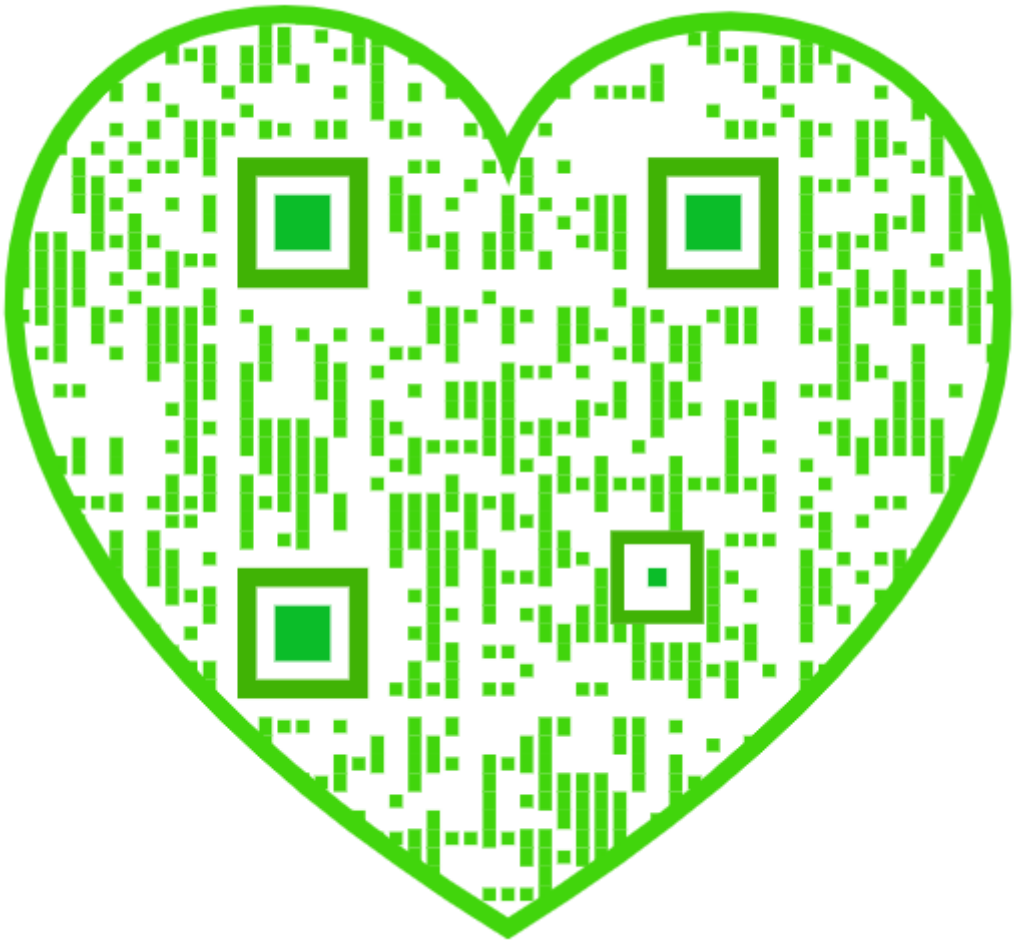
73

March 1961

37¢

AMATEUR RADIO

KEN W6NKE -61-



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6-band 100 watt AM transceiver

Sparkling new... smooth-working combo... a powerful 100 watt AM transmitter, sensitive dual-conversion receiver... two-way operation on 80-40-20-15-10 and 6 meters. This handsome, designer-styled package is just slightly over one foot long, less than six inches high, mounts handily under the dash of your car—blends in too, belongs. Transistorized DC supply is separate, mounts in any small convenient space.

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While G-76 is properly called a **transceiver** because of some common audio circuitry, transmitter and receiver are separately tunable. Receiver can be set to out-of-band DX, transmitter VFO anywhere within the band. Transmitter VFO is intended to be spotted on receiver dial. Frequency control may be either by VFO or quartz crystal. (Except on 6 meters which is crystal controlled only.) Transmitter and receiver oscillators are both compensated so that drift with temperature is negligible. Oscillator circuit has very low drift even with exceptionally wide excursions in both plate and filament supply voltages.

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COVER: Pen and ink sketch by Ken Johnson, W6NKE.

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. . . de W2NSD

(never say die)

Here is the sixth issue of 73. We're still around, still bringing you good articles and lots of 'em . . . plus eight more pages, thanks to the advertisers. Our original policies are still fairly intact. We're still not mad at anybody. Disgusted maybe, but not mad. We've been bringing you the promised technical and construction articles and, if the mail is to be believed, a lot of fellows have started building home-brew gear as a result.

Your Cautious Editor

Unfortunately for my piece of mind I am mis- or ill-informed on many subjects other than ham radio. This manifests itself, as with most would-be writers, in an ambition to write on these subjects. In an attempt to keep from lousing up this otherwise (possibly) interesting pamphlet with such drivel as might erupt when I attempt to over-compensate for a well developed inferiority complex, but still to provide a limited outlet for these psychic disturbances, I will channel my creative (?) energies to the office Ditto machine.

The point is this: if anyone is interested or morbidly curious enough to take the time and send a stamped self addressed envelope then I'll stuff some of my stuff and return it. Look what you get for 4c! All sorts of non-radio (usually) chatter on subjects you'd rather not read about and are sure to violently disagree with, stuff which I'd be out of my mind to publish in 73. Consolation: only one side of the paper will be used so you can tear the pages up and use the back for notes.

RTTY Dinner, March 20th

The Sixth Annual RTTY Dinner and General Conflab will be held Monday evening March 20th at the White Turkey Town House, 260 Madison Avenue (at 39th Street) in New York. The gathering commences at 5 pm, dinner at 7. Formalities will be interesting and brief. Reservations are extremely important this time: send $6.00 to Elston Swanson, c/o Instruments for Industry, 101 New South Road, Hicksville, L. I., N. Y. Please make your reservation as soon as possible.

New York Sideband Dinner

Ten years ago a small group of amateurs held a clandestine meeting during the heighth of the I.R.E. show. The way was hard for the Sideband pioneers and they needed to encourage each other . . . and perhaps they wanted to hear what someone's voice sounded like without the phasing rig between them.

This cautious gathering of avant-garde amateurs has now grown to a full fledged hamfest, complete with displays by manufacturers and a huge banquet at the Statler-Hilton. Send $10 for your ticket to the 10th Annual SSB Dinner to the SSBARA, c/o Mike Le Vine WA2BLH, 33 Allen Road, Rockville Centre, L. I., N. Y. 10 a.m. March 21st at the Statler-Hilton, with dinner at 7:30. Naturally 73 will have a booth.

Phoenix, May 26-29

The Southwestern Division ARRL Convention is girding itself for a real whingding affair over the long Memorial Day weekend. This should be one of the best Conventions in the western U. S. this year, so how about all you Southern Californians buzzing on over for a real western holiday. It may be a bit of a damper, but I'll be there wearing my western outfit. To make up for this we will also have on display our entire subscription department (see December cover.) This isn't enough? We'll also have on display our western representative Jim Morrissett WA6EXU, formerly Assistant Editor of CQ and foreign correspondent on "Frozen Jim" trip to Antarctica.

There will, fortunately, be a lot more interesting things than a vacationing 73 staff to look at. Like they will have prizes: a Viking Kilowatt & Ranger, an SSB station, a tower, a VHF tranciever, and scads of other goodies. Be sure to bring at least a station wagon so you can cart all that stuff home afterwards.

Registration is $8½ per. Send for info or send dough to George Mezey K7NIY, P.O. Box 814, Sun City, Arizona. This includes registration, the big banquet, and a breakfast.

Swampscott

Being only in the throws of preliminary organization and planning of 73 magazine last year at the time of the now historic Swampscott Convention, I unfortunately missed out on it. That is a blunder that I don't intend to duplicate this year. Possibly, for some reason of your own, you also missed this event last year . . . if so it would seem prudent for you to correct this error, if you are within driving distance.

There sure must have been a vacuum on the ham bands in the first district last year

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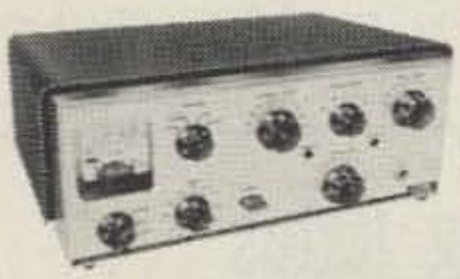

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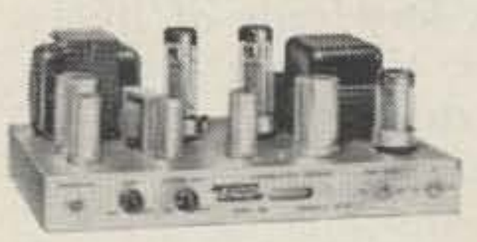

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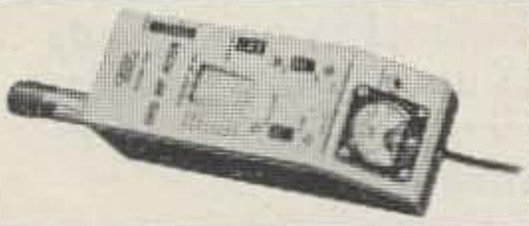

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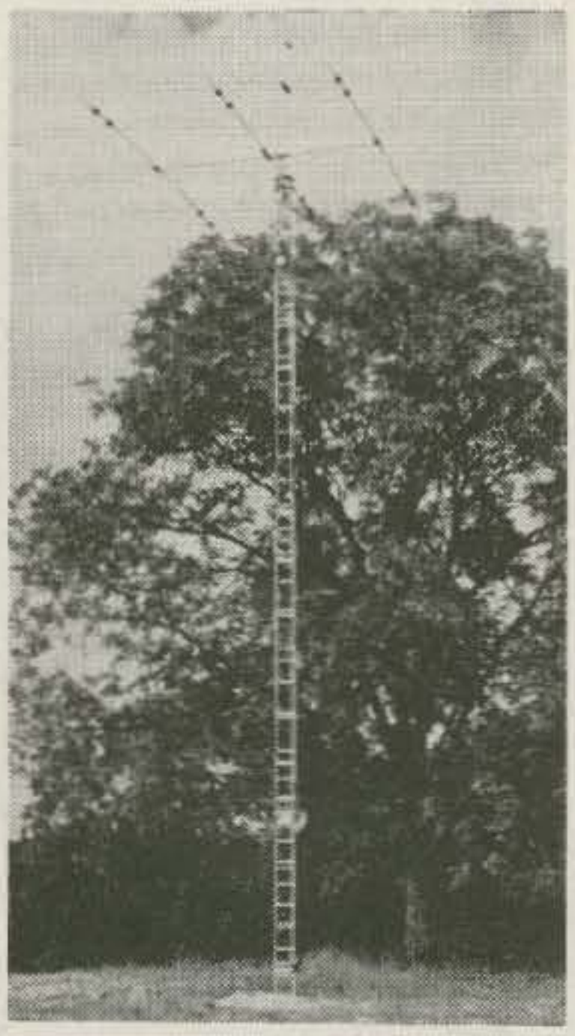

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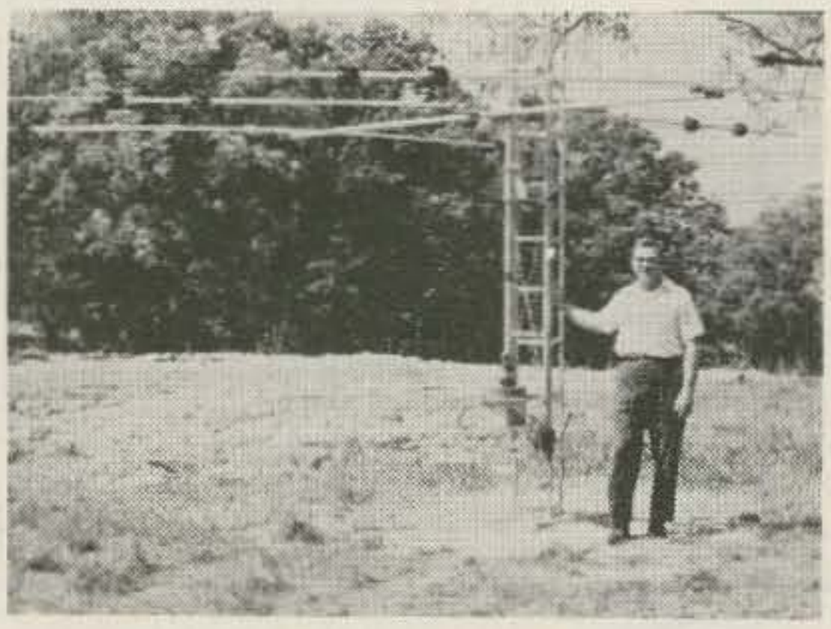

We hope you can see in the photo how the array and the rotator both go up and down the Hy-Track on rails. When you crank it to the top it locks in place. It automatically unlocks when you want to lower it again. Note how little ground area is needed.

What you do next: Send for prices, specs, etc.

Write to:

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with 3500 hams were off the air all at once. Imagine the poor guy with the little DX-35. He gets on the air on 20 and calls a CQ. Suddenly there are stations calling him from all over . . . he's the only W1 on the band! He doesn't know this is because everyone else is jazzing it up down in Swampscott, all he knows is that everyone is calling him and he is the loudest W1 on the band. This is an evening he'll never forget.

The other 3500 are having an evening they'll never forget too. Decide now which it will be for you: the Convention or lots of DX all to yourself. Write Radio Convention, 15 MacArthur Blvd., Danvers, Mass., for registration forms which are good until March 25th. The Convention is April 8-9, two days.

73 will be there, complete with the Subscription Department. Virginia wants to know if anyone will volunteer to help her keep eager subscribers orderly? . . . W2NSD

LETTERS

Dear Wayne:

The Microwave Society of Long Beach has just been formed and club meetings are held on the second Wednesday of each month at the Bayshore Public Library, 2nd Street and Bayshore Avenue, Long Beach at 8 p.m. We have plans for construction projects that you might be able to use in 73. Can you put this in 73?

Ralph Steinberg K6GKX

No.

Dear Sir:

I saw one issue and I think you have something there. What we need is more technical and construction projects and less ads. We can get all the catalogs we want for nothing. We don't have to subscribe to them. Hi. Hi.

. . . Leo Masterson W3IXO

It is refreshing to find such naivcté at this late date. I wonder how fast Leo would rush in his subscription to 73 if he had to send in $10 a year? This is what it would have to cost without the ads. It costs us over 50¢ per copy to produce the magazine at its present size! No, Leo . . . you look carefully at the ads and thank each one for their cooperation in bringing you this magazine . . . without them it would be impossible to publish any ham magazines.

Advertising Rates

There are probably hundreds of likely advertising prospects that we haven't contacted. Since our rates are so ridiculously low it might just be clever to unveil what remaining shrouds of secrecy there are about them. They'll be going up shortly anyway. Note that our 1" ads are only $12 on a 12X basis, making it a fine deal for smaller companies that want to keep their name alive.

1	page	$120	¼	page $40	(4")
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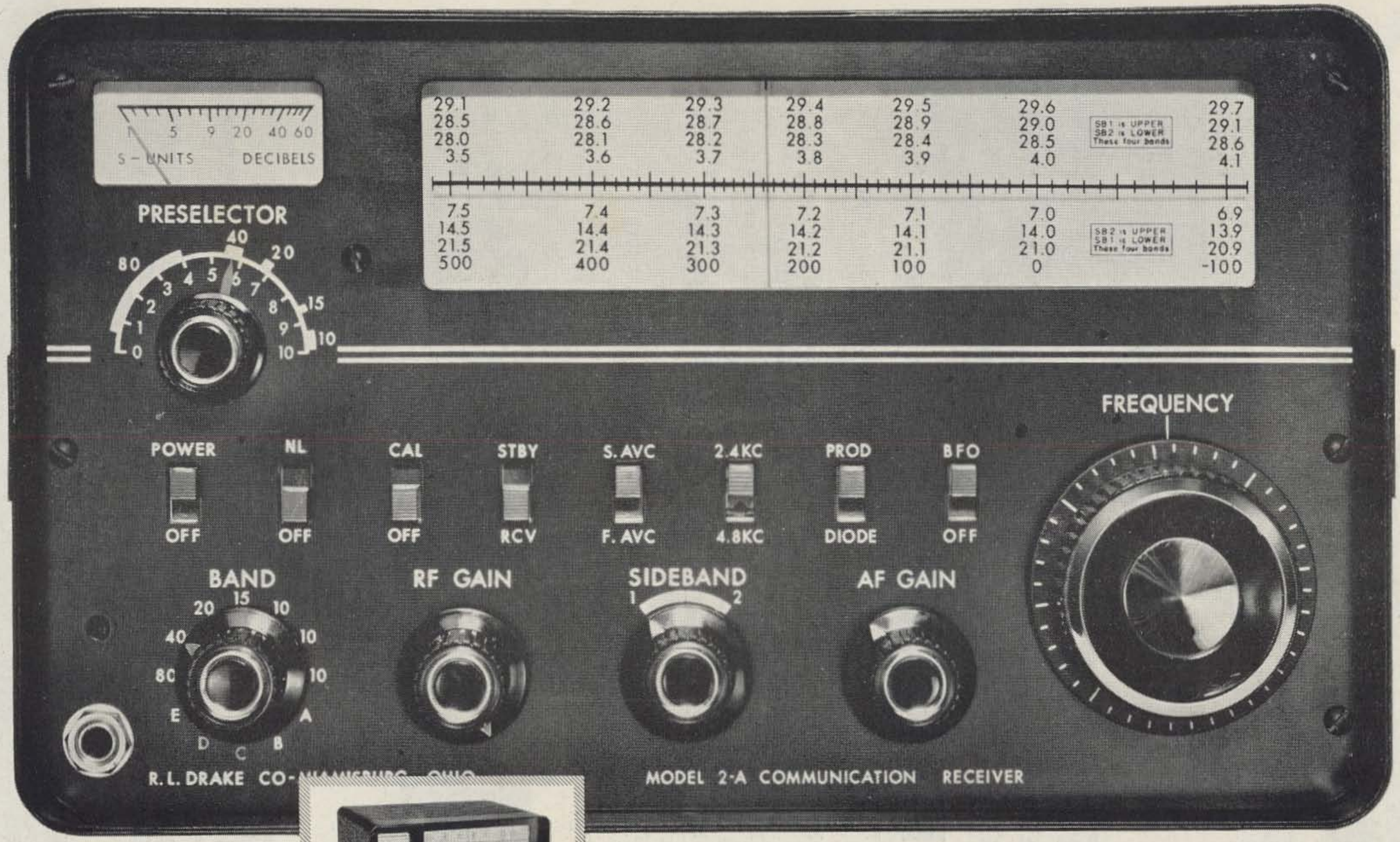
			1/16	Page $15	(1")

Frequency discount: 6X—10%; 12X—20%. Closing date: 5th of the previous month.



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"TAILORED" audio filter-Audio limiter.

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How To Read What the PhD Writes

Handy Translator for Scholarly Publications

Jim Kyle, K5JKX/6

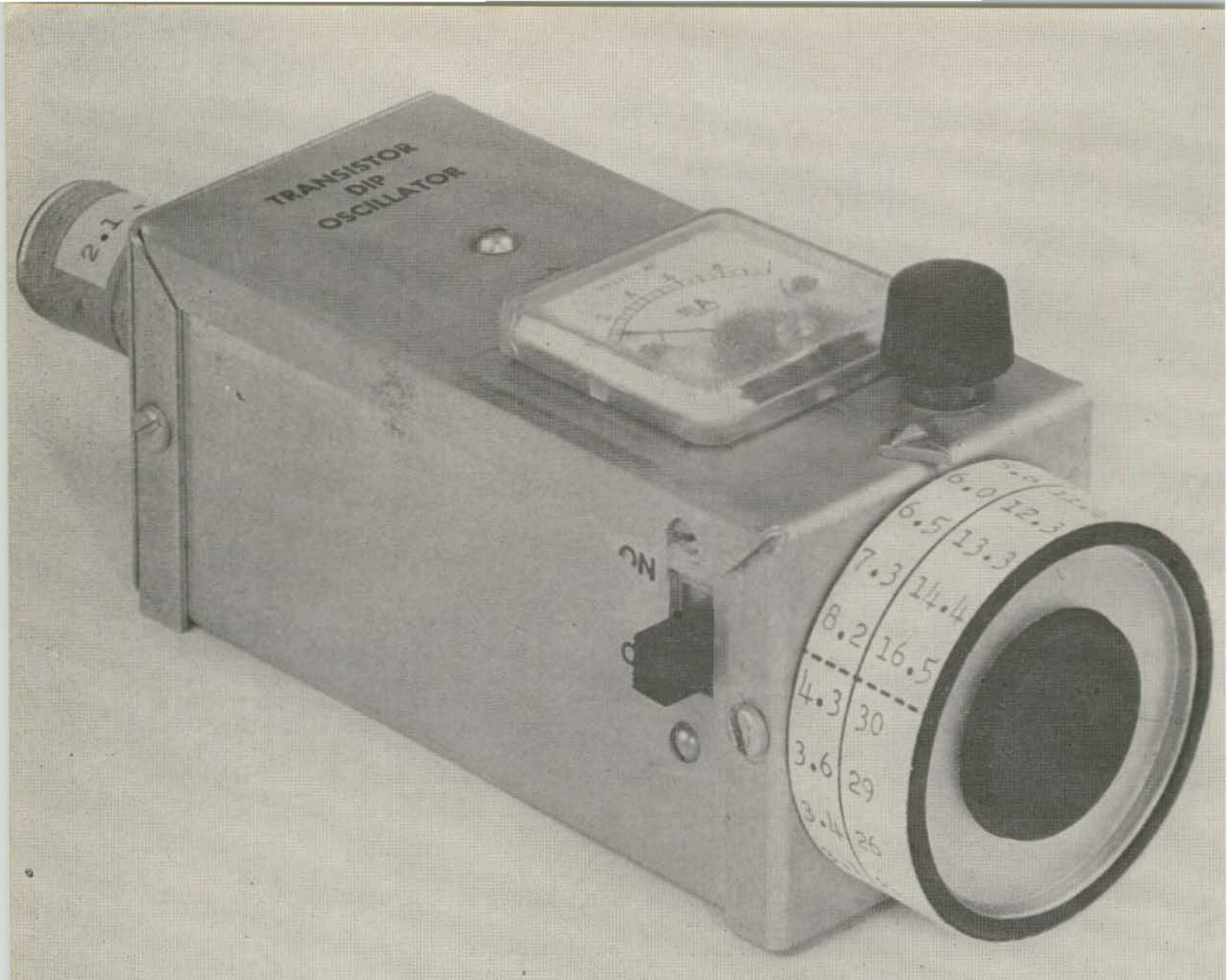
WHAT with the rapid advances being made by the commercial boys these days, not to mention the research carried on by government-sponsored laboratories, the ham who wants to keep ahead of the game almost has to read several of the "Scholarly Publications" devoted to electronics at the design-engineering level.

However, these people have a language all their own—or at least that's the way it seems to the tyro braving the thin air of the high-level research report for the first time. Translating this language into ordinary ham-style English is one of the fine points of the preparation of 73.

But, since many of us like to keep even farther ahead of the game than is possible within the covers of just one magazine—even so chock-full-o'-content a publication as this—we're about to open our top-secret file and provide you a Guidebook to the High-Level Report. With it, you can at least find out what the engineer meant to say. Ready? Here goes:

As Written	Meaning
It is common knowledge in the field	I didn't bother to look up all my references.
. . . of extreme theoretical and practical importance	I found it interesting, you should too.
While it has not been possible to provide definite answers to all of these questions ..	The experiments didn't work, but I thought I could at least get a write-up.
. . . on as broad a basis as possible	The budget was slim.
. . . steps are being taken	I'm trying to convince the boss we need more money.
. . . requires computational facilities of considerable complexity	Where's another box of scratch pads?
Reasonably stable signal	You can track it with the tuning knob if you're fast.
Ultra-stable signal	You don't have to track it.
Extremely precise signal	See "reasonably stable signal."
. . . presently under study	We talk about it at coffee time.
It is suggested that	I think.
It is generally believed	A couple of other guys think so too.
Within an order of magnitude	Between a tenth and ten times what I said it was.
Typical results are shown	The best results are shown.
. . . well below	Greater than .....
. . . surprisingly low error	Something's wrong—it agreed with my calculations!
. . . to a first approximation	to a random guess.
. . . introducing the constant factor B	By introducing B, I can solve the equation. Any other way, it doesn't make sense.
. . . optimum performance was achieved with the circuit shown	This circuit worked. All the rest failed.
. . . appears entirely practical for our use	Hams have been doing it for years, why can't we?
It is to be hoped that this effort will stimulate additional research	I still don't understand it, and neither does anyone else I could locate. Won't somebody please try it too and explain it to us?

. . . K5JKX/6



Grid Dip Meter, Transistorized, Improved

Melvin Leibowitz, W3KET
220 West Fourth Street
Wilmington 1, Delaware

THE grid dip meter is probably the most useful piece of test equipment available to the ham. Battery operation is desirable for several reasons:

1. The instrument may be used outdoors for antenna work.
2. Lack of "warm-up" time.
3. No trailing cord to get in the way.

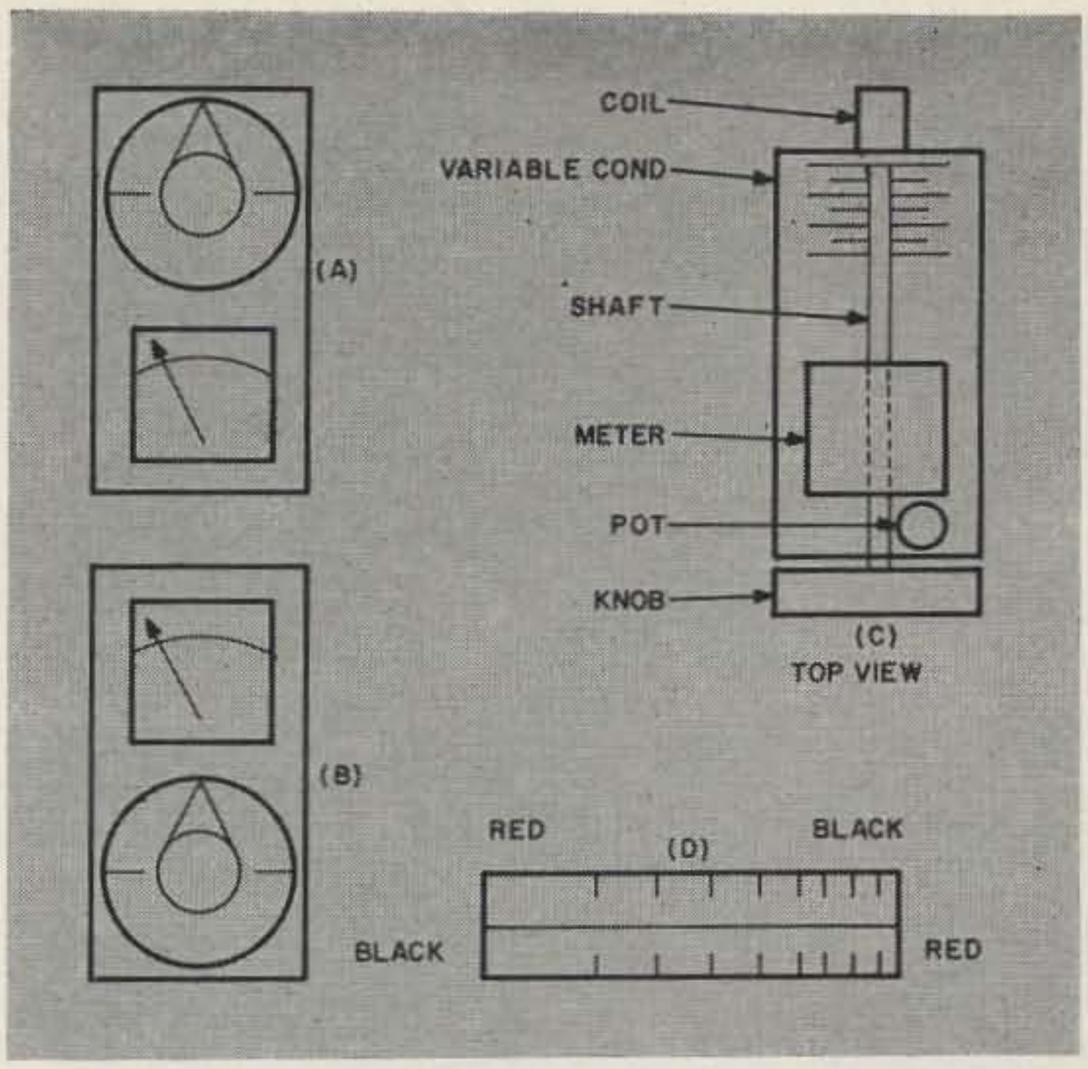
If the instrument is to be battery operated it should be transistorized for maximum battery economy and light weight. Such grid dippers have appeared in ham literature [1, 2] but they have several common faults:

1. The mechanical design is difficult for the average ham to duplicate.
2. Calibration scales are hard to make and look sloppy unless the constructer is a skilled draftsman.
3. The coil forms are usually required to have more than two contacts. This dictates the use of an Amphenol series 24 coil form and socket. These forms do not lend themselves to quick and easy changing which is highly desirable.
4. The usual design is awkward to hold and use. Consider the design shown in Fig. A with the dial at the top of the instrument and the meter below it. This type is easy to make but unfortunately the user's arm obscures the meter when turning the dial. The dial might be placed below the meter as in Fig. B. This results in long leads between the coil and condenser and is undesirable. Commercial instruments get around this problem by bringing the rim of the tuning dial out the side of the case. This type of instrument is difficult to hold, build, and calibrate.

The type of construction shown in the photograph and Figure C eliminates all of the above problems. The condenser is located close to the coil and is turned by an extension shaft coming out the end of the box. The instrument is comfortable to hold. The only metal fabrication involved is a simple "L" mounting bracket for the variable condenser. The calibration scale is a flat strip of paper glued to the rim of a *National* HRT knob. Since the calibration marks are on a straight line they can be typed in on an ordinary typewriter for neatness.

Sharp eyed readers will note the use of *Amphenol* series 24 coil forms which I have previously condemned. The electrical circuit has been revised so that only two pins are needed on the coil form. The unused contacts are removed from the coil socket. This reduces the friction considerably and the coils are easy to change yet a good electrical contact is still maintained.

The oscillators shown in previous articles employ the unused pins on the coil form to vary the bias on the transistor as the frequency is raised. Since we have limited our-



selves to only 2 pins we cannot use this approach and a potentiometer has been substituted for the fixed resistors. This produced a bonus in that it is possible to set the pot for relatively weak oscillations. Under such conditions the meter will give a good dip with very loose coupling to the tuned circuit.

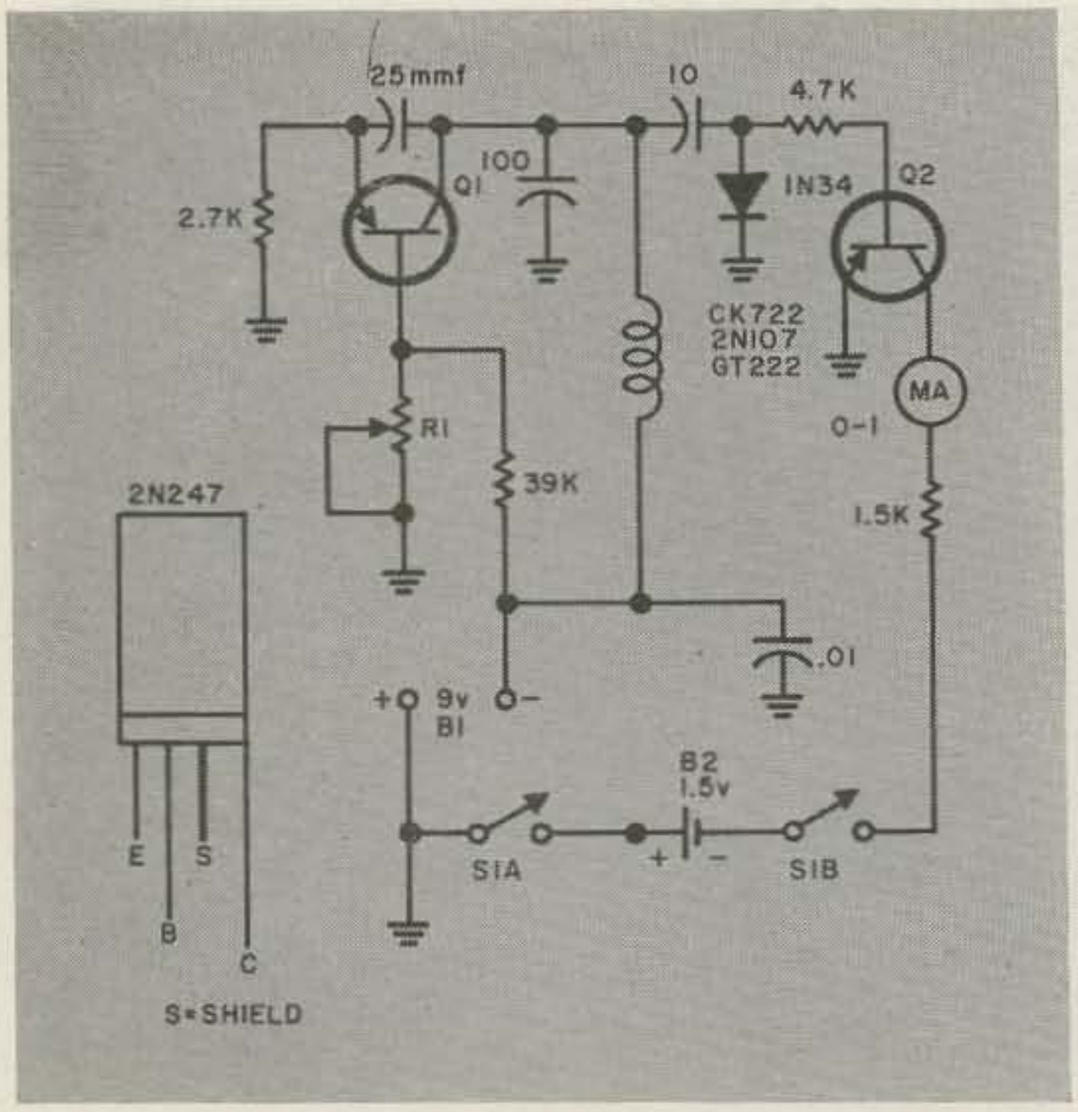
Most of the constructional details should be evident from the photographs, except for the mounting of the *Amphenol* 78S5S coil socket. This socket is designed to be mounted by means of a retaining spring. This does not give a good solid mount. Obtain a top mounting, bakelite, 9 pin miniature tube socket. Crumble the bakelite part by squeezing it in a vise. The object here is to free the metal mounting ring so that it can be used to mount the coil socket. File 2 round notches in the coil socket so that the retaining ring will slip over the socket from the top. The socket may now be bolted to the chassis just like any other socket. Place two or three small washers under the ears of the mounting ring to make up for the difference in thickness of the ring and socket. Remove all but two of the contacts from the socket before mounting it in the chassis.

The unused contacts are removed by bending them with a pair of fine-nose pliers until they break off. The contacts inside the socket will then fall out. Sub-miniature tie points are mounted on each of the meter terminals to aid in point-to-point wiring.

The meter will oscillate readily up to approximately 35 megacycles using a 2N247 transistor. Use a 2N384 in place of the 2N247 if the six meter band is desired.

Calibration

Calibration is divided into four overlapping ranges. Two of the ranges occupy 180 degrees of the dial. The scales may be typed on a typewriter as already mentioned. It is prefer-



able to use a two color ribbon such as a red and black. This will help to separate the scales. The finished calibration will then look like that in Figure D. Cut a sheet of good quality paper the same width as the rim of the knob and long enough to go around the rim with about a half inch overlap. Attach one end of the strip to the knob by means of Scotch tape. Wrap the strip around the knob and hold it in place with a rubber band. Calibration is most easily accomplished by listening to the oscillator on a continuous coverage receiver. As each point is found, mark the paper with a light pencil mark. Pencil in lightly the frequency for each park to avoid confusion. After all calibration points have been found, transfer the paper to the typewriter and type in the figures. The lines may be inked in with India ink or a ball point pen. Erase the pencil marks with a soft eraser and re-attach the paper to the rim of the dial using a piece of Scotch tape. Wind the scale around the dial just as before except this time anchor the free end of the scale with tape. Continue winding the tape completely around the scale being careful to avoid wrinkling the tape. The tape will protect the scale against wear and soiling. Tune a receiver to one of the calibration frequencies, insert the appropriate coil in the dipper and set the dial to aforesaid calibration frequency. Loosen the set screw in the shaft coupler between the variable condenser and knob shaft. Rotate the variable condenser until the oscillator is heard in the receiver. Tighten the set screw and the job is done.

Operation

The various applications of the dipper are well known and will not be repeated here. The transistorized dipper should not be used as an absorbtion wavemeter as the transistor will likely be damaged due to excessive rf. In use, the pot is set so that the meter reads half scale or slightly less. The meter is most sensitive at this point. The actual setting of the pot will vary with the different frequency bands covered. Do not allow the meter to read more than half scale as it will be difficult to get a dip under such conditions. . . . W3KET

1. Radio Amateurs' Handbook; 37th. Edition page 520.
2. CQ; page 56, Sept. 1958.

Parts List

Q1—2N247 or 2N384 (see text).
Q2—Any PNP transistor that works (not critical).
B1—Burgess 2U6.
B2—Burgess N or NE (if type N is used, wrap in insulating tape). S1ab Double pole single throw slide switch.
R1—10K subminiature pot, Philmore #PC51.
Cabinet—LMB #TF778, 2¼ x 2¼ x 5.
Ma. 1½" 0-1 Ma. DC

Coil Chart

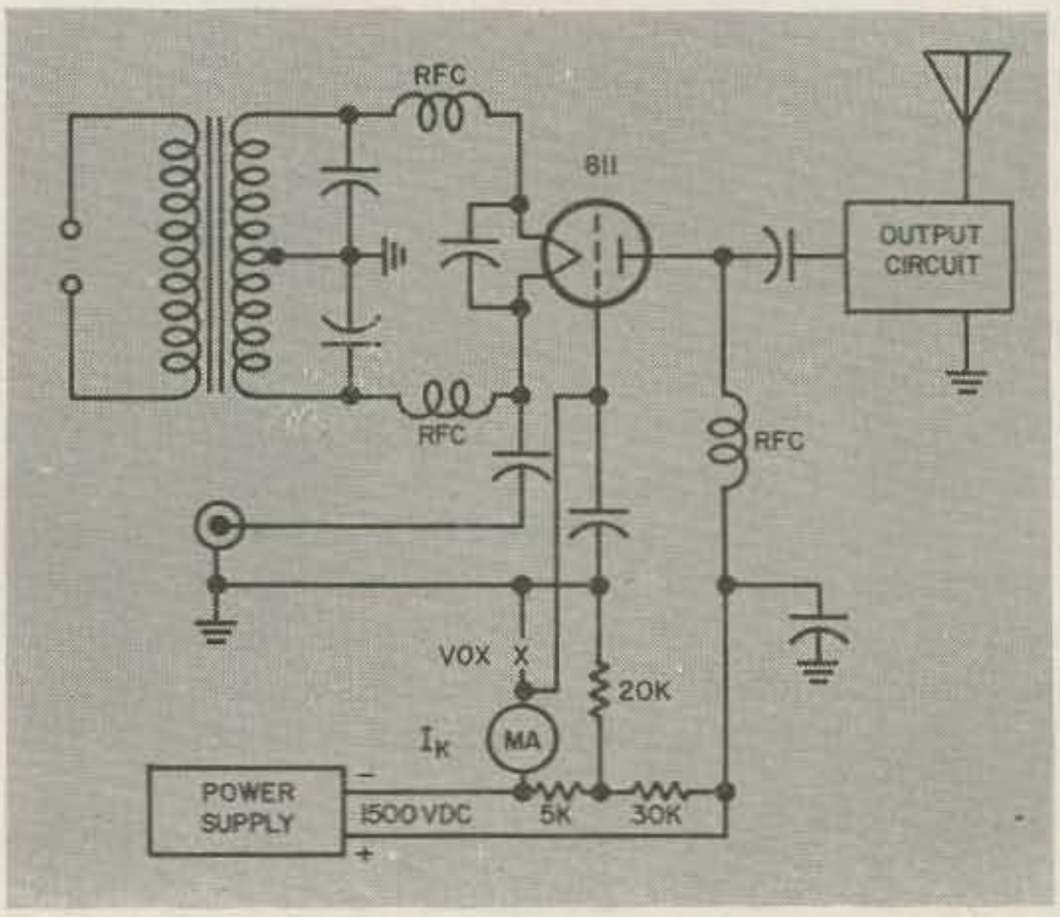
Band	Frequency (mc)	Turns
1	2.1- 4.3	63
2	4.3- 8.6	24
3	8.6-17.2	9
4	17.0-31.4	4

All coils except #4 close wound on ¾" form (Amphenol 24-5H).

#4 spaced diameter of wire.
#28 D.C.C. used for all coils.

SHORT ITEM

HERE is a circuit which may be of general interest. It has been built into several rigs here and has been proven quite satisfactory. Its theory of operation is quite simple. In standby position the zero bias triode sees blocking bias across the 5K portion of the bleeder, the cathode seeing the positive end of the 5K resistor through the 20K resistor. In transmit position the grid is grounded by the VOX relay resulting in a simple grounded grid circuit.



Robert Lile K6QGE, WA6LFD
Jr. Eng., Jennings Radio Mfg. Corp.

Eliminating Ignition Interference

Chuck Schecter W8UCG
630 Glenwood
Muskegon, Mich.

THE following instructions represent the most common cures for mobile interference to radio reception. These instructions apply to all frequencies from the Broadcast band through the Very High Frequencies and include Amateur, Commercial and Citizens Radio Services. Every possible source of noise is not necessarily covered in detail. It is suggested that each step be followed in the sequence shown—stopping whenever the interference has been reduced to a satisfactory level. Steps 1, 2 and 3 generally provide about 80% noise reduction.

1. **GENERATOR**—Install a Sprague 48P18 coaxial condenser in series with the wire on the "A" (Armature) terminal and fasten the mounting bracket securely to the generator frame. See diagram. A clean commutator and good brushes are also important.

2. **SPARK PLUGS**—"Resistor" plugs are the first choice and are the most effective. They should, of course, be kept properly "gapped." Second choice would be a *good grade* of suppressor—5,000 ohms for each plug and 10,000 ohms for the distributor "hot" lead. Engine performance is NOT affected. Also check the metal "tips" on EACH END of the coil and plug wires to be sure that there are NO "gaps" here! Clean and solder these wires to the tips.

3. **VOLTAGE REGULATOR**—Install one Sprague 48P18 in series with the wire on the "A" (Armature) terminal and also one of the same in series with the wire on the "B" (battery) terminal of the regulator. See diagram. Secure the mounting bracket to a good "ground" on the body CLOSE to the regulator. Install a 3.9 ohm, 1 watt carbon resistor with one end connected to the "F" (Field) terminal of the regulator and the other end connected to one of the wire leads of a Sprague 46P12 coaxial condenser. Clip off the other wire lead of this condenser and secure the mounting bracket to a nearby body "ground." See diagram.

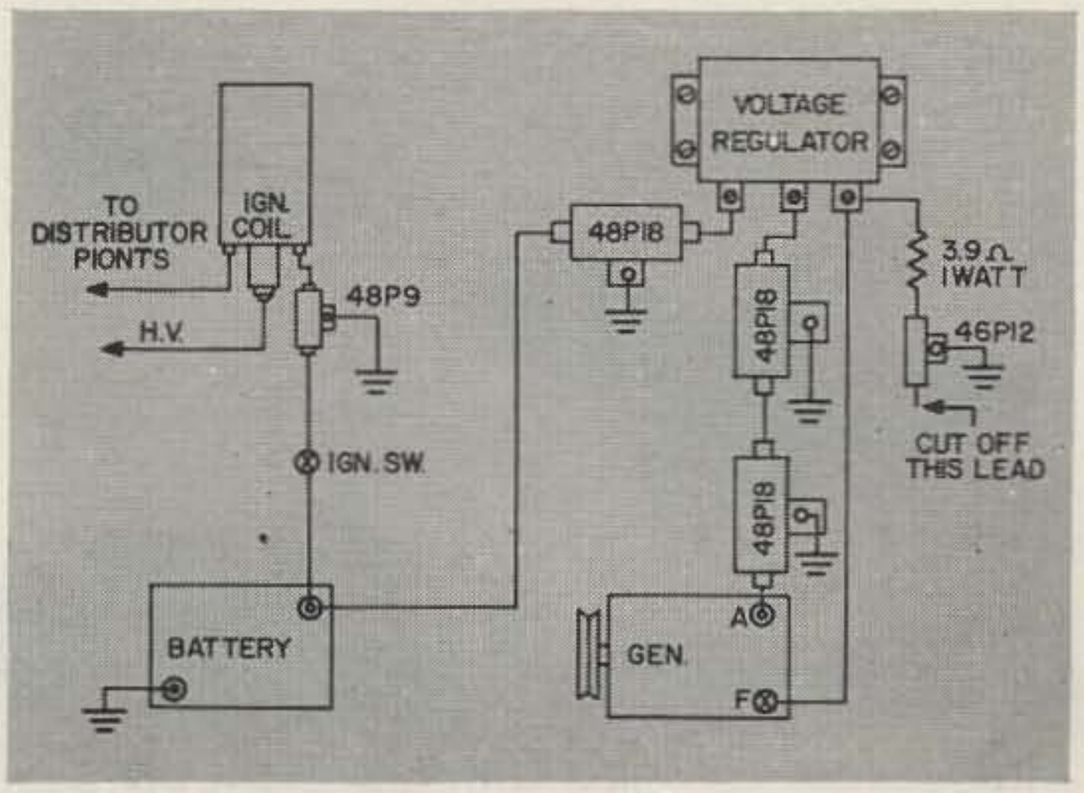
4. **COIL**—Install a Sprague 48P9 coaxial condenser in series with the coil primary *battery* lead *at the coil* and ground the mounting bracket at a *nearby* point. See diagram.

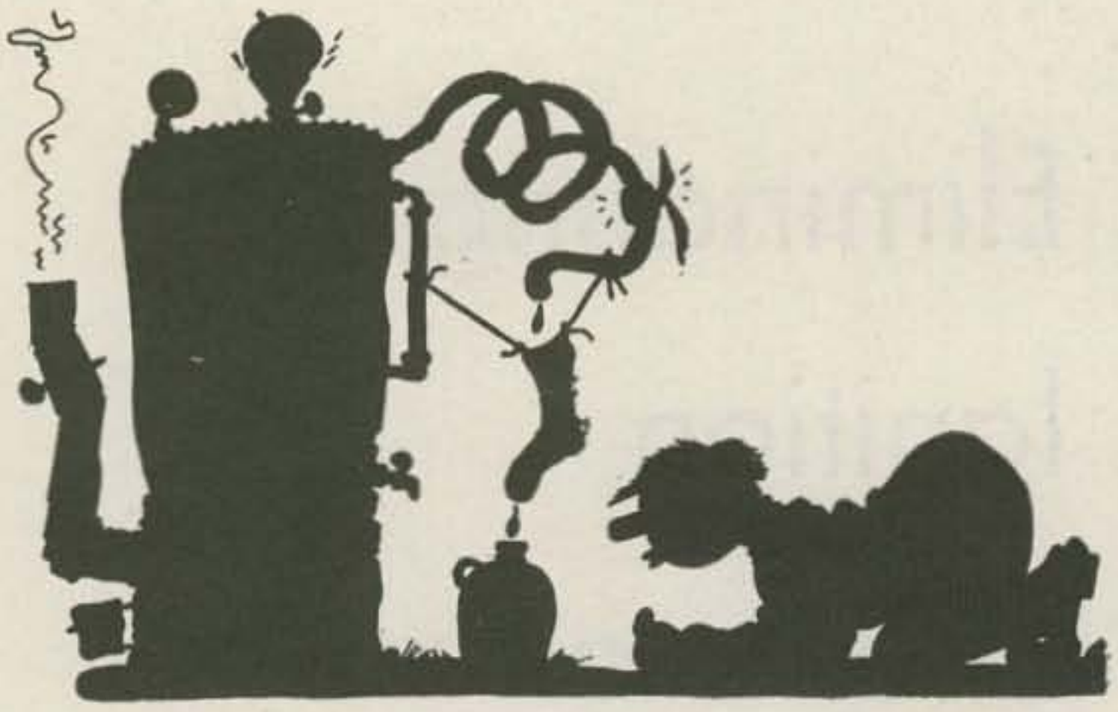
5. **BONDING**—Additional noises are often eliminated by "bonding" various portions of the vehicle together by means of a flexible tinned-copper bonding braid such as Belden 8668 and 8662. Use the 8668 to "bond" choke, temperature and control cables to the body or frame *where they pass through the firewall.* Use heavy-duty braid 8662 to bond the exhaust pipe, muffler, steering column, engine block and firewall to the car frame.

6. **GAUGES**—The gas, oil, heat and other gauges can be checked for noise by disconnecting temporarily. Any noise generated may be eliminated by installing a Sprague 48P9 in series with the "hot" lead of the offending gauge AT THE GAUGE.

7. **WHEELS AND TIRES**—Wheel noise may be eliminated by installing special spring-type static collectors in the front wheel bearing caps. Tire noise may be eliminated by injecting a special graphite powder into the tires with a special injector.

It will very seldom be necessary to complete *all* of the above and generally satisfactory radio reception is obtained after completing as few as one, two or three steps.





Rule 4. "Use plenty of filtering. . . ."

10 Rules of Thumb for the SUPERREGENERATIVE RECEIVER

Howard F. Burgess, W5WGF
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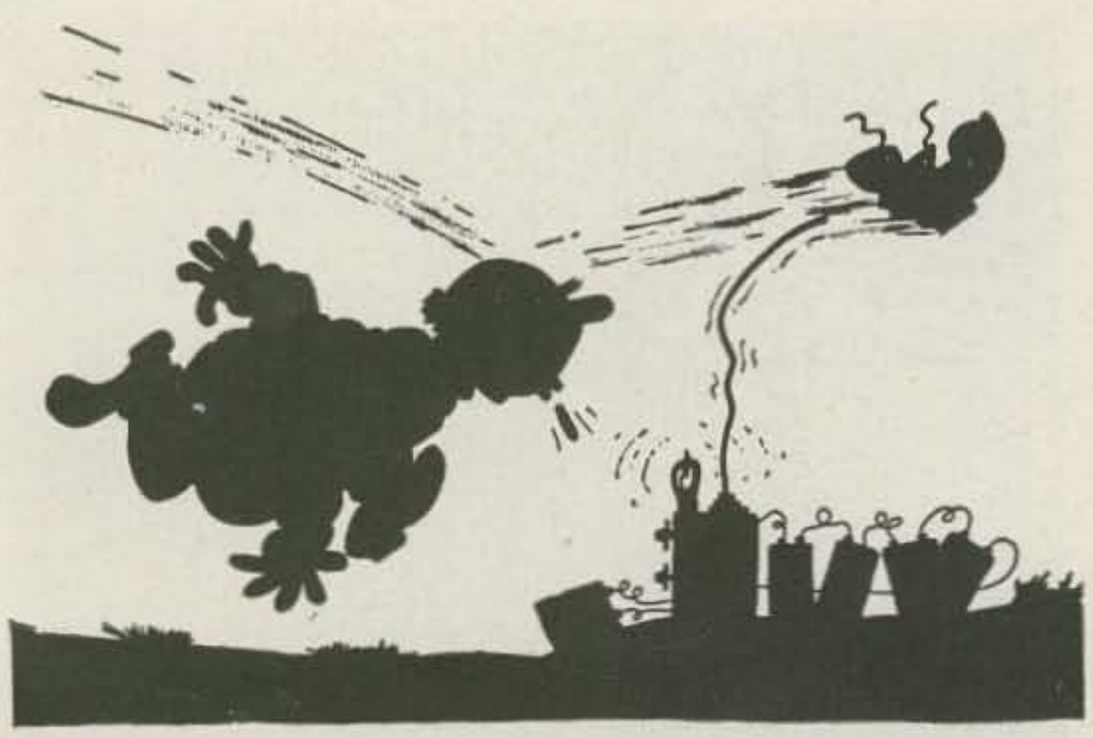
Albuquerque, New Mexico

THE many new uses for radio receivers, which include the Citizens Radio and paging services, have created a need for small receivers. As a result superregenerative receivers are enjoying a return to popularity. Their high sensitivity and their ability to reject certain types of noise make them very useful when low current drain is important. However the superregenerator is tricky and many of the techniques that help to make a good receiver seem to have been lost since their last peak of popularity. The work of many experimenters can be summed up in a few "rules of thumb" to guide the designer and builder.

1. Operate the superregenerative detector with 30 volts or less on the plate. With modern tubes a well-designed circuit may operate with as low as 4 or 5 volts. By using low plate voltage, interference to other receivers is reduced and sensitivity is often increased.



"Reduce interference with low plate voltage.

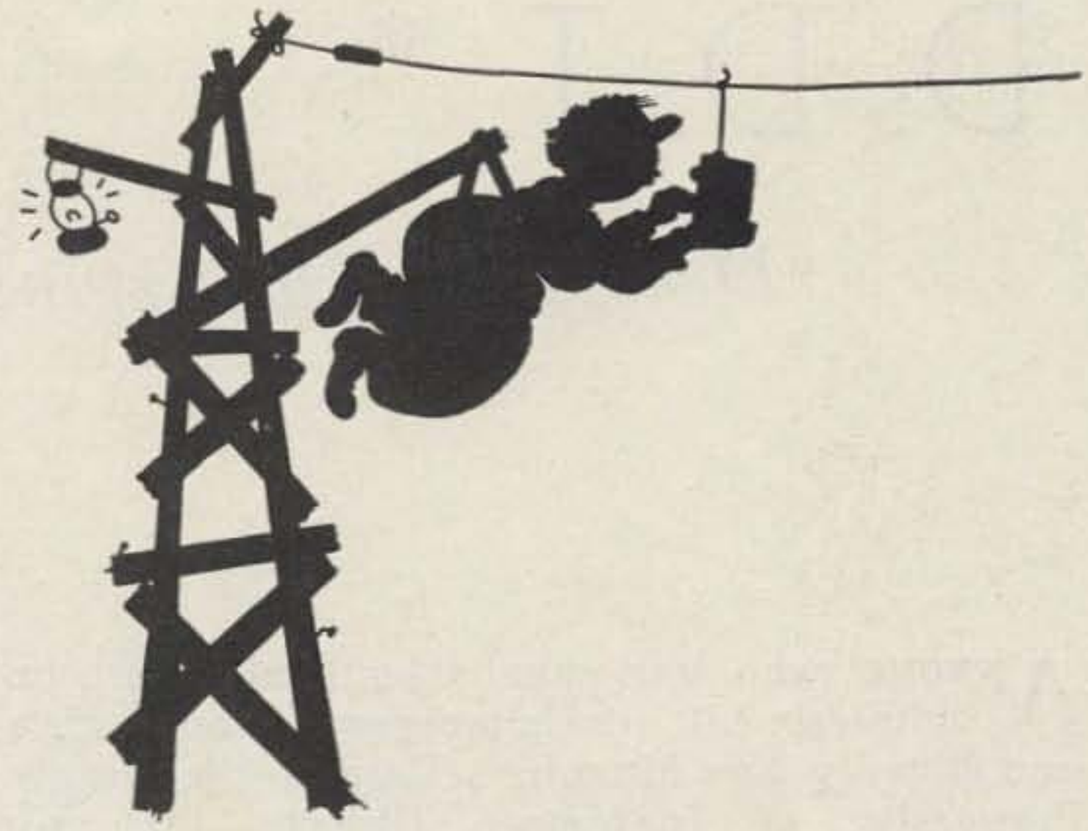
Rule 5. "Use cheap transformers. . . ."

2. Avoid using a tuned amplifier stage ahead of a superregen detector if it is tuned to the same frequency as the detector. Instability will usually result. Try using an untuned grounded grid stage.
3. Use a low quench frequency (10 kc to 20 kc) for improved selectivity. A higher quench frequency will give better audio quality and greater sensitivity. However, a high quench frequency may cause multiple spot tuning.
4. Use plenty of filtering to remove the quench frequency from the audio output of the detector. The first audio stage on many receivers is overdriven with a quench voltage that is above audibility. This will reduce the effectiveness of the receiver.
5. If it is practical, use an audio transformer to couple the detector to the first audio stage. Usually the cheaper the transformer the better, as a poor transformer will pass less of the high frequency quench voltage.
6. Use a variable padder for the grid condenser of the detector. This will solve many of the headaches of getting proper operation. This adjustable capacitor will give control of the

Rule 8. "Separate quench requires a few more parts. . . ."

time-constant that determines smooth quenching action in the self-quenched detector.

7. Satisfactory superregeneration becomes increasingly difficult below 4 megacycles. Operation is very good upwards from 10 mc well into the kilomegacycle region.
8. In most cases a separate quench oscillator will prove superior to a self-quenched detector but such a circuit requires a few more parts and adjustments.
9. A superregen will give the best results when tightly coupled to the antenna or preceding stage. If it has been designed to operate on low plate voltage, tight coupling will not cause objectionable radiation.
10. Contrary to popular belief, a good superregenerative detector does not sound like a power saw in a pine knot. When properly adjusted a good detector will have very little more background noise than a superhet receiver.



Rule 9. "Tight coupling helps. . . ."

Of course all rules are made to be broken and a very good receiver can be made by breaking all of the above suggestions . . . but the odds are against you if you insist.

. . . W5WGF

Rule 10. "Contrary to popular belief. . . ."

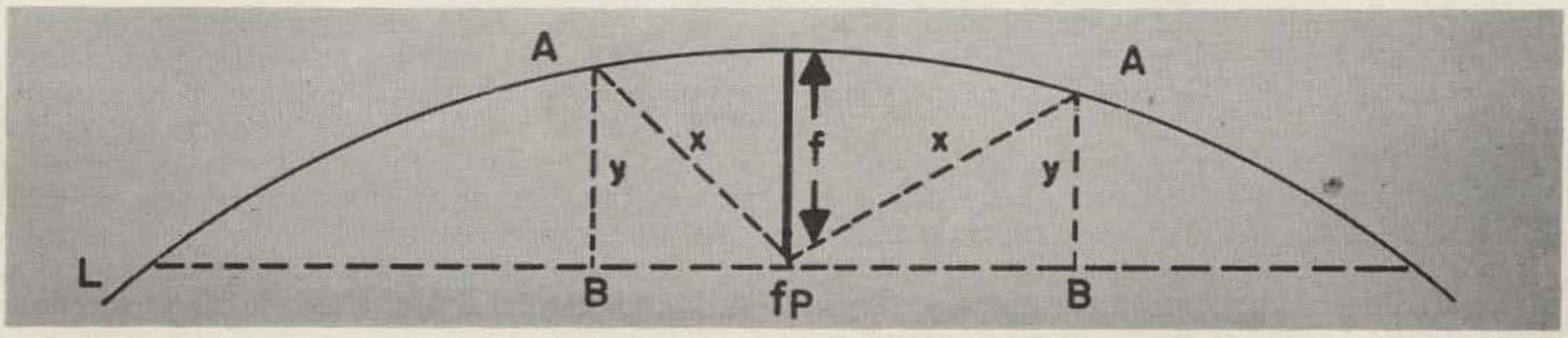
DRAWING A PARABOLA

W7FGG via W9ALU

VHF men, particularly those interested in building antennas for 1296 mc, may be interested in a simple method of drawing an accurate parabolic curve.

When we take the basic idea that in a parabolic curve with the focal point (f) at the mouth of the parabola, the width is 4f and x plus y is always 2f, then we can set up a mechanical method of tracing this curve.

Choose the mouth width you want and draw a line (L). The center of this line will be the focal point (fp). Tie the end of a string which reaches from fp to L to a nail and nail it at fp. The other end can be tied to another nail which you can run along the line fp-L. By letting the string slide around a pencil at point A and keeping y perpendicular to fp-L your pencil will draw a parabolic curve.



D. D. T. *

**Decreasing Debugging Time*

Jim Kyle, K5JKX/6
Associate Editor

ANYONE who has ever attempted even the simplest bit of homebrew construction undoubtedly has Murphy's Law of the Innate Perversity of Inanimate Objects—"If any item can possibly fail to operate properly, it will!"—committed to memory the hard way. One of the major selling points of factory-built and kit-styled equipment, in fact, is that all design bugs have already been eliminated from it.

Despite the bugs, though, there's a certain satisfaction in homebrewing that no amount of factory-built gear can duplicate. Besides, what else can you do if no one is marketing the kind of equipment you need?

Since every design, by Murphy's Law, will contain a few bugs in unpredictable locations, the happiest way to solve the problem is to establish a procedure for "debugging" each new project as painlessly as possible immediately upon completion. The purpose of this article is to describe such a procedure in a form which can be adapted to any needs.

For the purpose of chasing them down, bugs can be grouped into two major classes: those due to design, and those due to construction practices. Within each of these classes, subdivisions may be established.

Design bugs frequently encountered include oscillation, parasitics, other forms of instability, and overheating of components. All of these may be found in transmitters, receivers, audio equipment, and most other electronic gadgets.

Construction bugs include all of the above, as well as unwanted hum and noise, and spurious signals.

One of the first steps in the debugging process starts before construction commences: a careful review of the planned project to try to detect any possible design trouble areas. Since this step has been adequately covered elsewhere, it will not be described further. For our purposes, debugging will be considered as starting at the completion of construction.

Before applying power to the equipment, a detailed inspection of the finished job is in order. While it's usually hard to wait before turning it on, this inspection can frequently save valuable components from damage if you detect inadvertent wiring mistakes such as having the high-voltage line connected to grid instead of to plate on a 4X250B.

Shake out all the bits of solder and other construction debris after your inspection, but don't turn the gear on yet. Step number two is a point-to-point check, using your ohmmeter. This double-checks your inspection. Test for continuity in all filament and other applicable circuits. Measure resistance from the high-voltage line to ground; this reading should be almost zero initially, increasing rapidly to the value of the power-supply bleeder resistor.

The third step—Stay away from that power switch for a few minutes more!—is to disconnect the high-voltage leads temporarily and connect jumper wires leading outside the chassis. With high voltage circuits broken, you can now turn the equipment on—but be careful to keep clear of the exposed high-voltage leads.

If no smoke pours forth, and all filaments light properly, you're doing fine. At this point you can be reasonably certain that you have made no wiring goofs; you still don't know about all the other possible bugs.

In the next step, you have a choice. The objective is to operate the equipment at reduced plate and screen voltages. You can either connect a heavy-duty resistor of the appropriate value in the external high-voltage jumpers, or you can steal power from a lower-voltage supply in other equipment.

If you steal power elsewhere, be certain that you never apply voltage to the screen of any tube unless plate voltage is applied at the same time. Application of screen voltage only will permanently damage the tube, by permitting excessive screen current flow. You can, however, apply voltage to the plate only if you like without damage.

The value of reduced voltage to use will vary with the equipment being tested and with the availability in your shack of suitable resistors and/or lower-voltage power sources. The best starting point is approximately 50 percent of operating value.

If the equipment under test is a transmitter, be sure to load it with a dummy antenna. Any signals emitted during the test procedure

are sure to be sour, and might earn you a pink ticket if sent into the ether! Besides, FCC regulations call for all tests and adjustments to be made into dummy loads.

At this point, turn on the power. Observe any built-in metering for indications of improper performance (but be sure to make allowance for the departure from design voltages in assessing what constitutes "improper" operation). If all goes well and there's still no smoke, go through the entire planned operating procedure, watching carefully for any signs of parasitics, instability, or overheating.

If neutralization will be required, make the necessary adjustments during this portion of the test. They will have to be touched up later when full voltage is applied, but will be at least in the right ball park at that time.

With everything working properly at this stage, you're ready to cut power, remove the extension jumpers, replace the internal power-supply connections, and try at full operating power.

Test procedure here will be a repeat of that performed at reduced voltage. If you find no troubles, congratulate yourself—you will have produced a virtually bug-free design.

Tests for spurious signals, noise, and frequency instability are best made on the air with assistance of a cooperative friend. Keep in touch with him by landline and make sure your test transmissions are as short as possible. Have him check your signal for all listed faults, as well as anything else he can think of. And make sure he gives you an honest report; it's better to hear the bad news from him than from an Official Observer or, worse yet, an FCC monitor.

So far, we've assumed that the equipment passed every test with flying colors. What if bugs make themselves known?

Existence of the troublesome bugs is easy to detect. Parasitics usually manifest themselves in a transmitter by a buzzing sound, and can be heard on a receiver tuned near the signal frequency. Parasitics in a receiver or an audio amplifier appear as a squawk in the speaker.

Instability in a transmitter appears as a sudden climb in amplifier plate current, as a "wandering dip" in plate circuit tuning, or as a "squeal" in a receiver tuned to signal frequency. Instability in a receiver or an audio amplifier shows up in the speaker.

Frequency drift shows up as a slow movement of the signal when it occurs in a transmitter, and in a receiver is manifested by drift of all signals including broadcast stations and WWV (neither of which drift a detectable amount within a 24-hour period). Overheating is detected visually (by looking for red plates in tubes and for smoke curling up from beneath) and by nose (for the smoke).

Usual causes of these bugs are listed in Table 1. Cures are listed in Table 2.

BUG	USUAL CAUSE
Parasitics	Unwanted resonances in amplifier circuits; Improper time constant in oscillator gridleak circuitry.
Instability	Unwanted regenerative feedback around amplifier stage; Improper shielding of transmitter stages; Stray coupling.
Frequency Drift	Insufficient isolation between oscillator and other circuits; Improper mechanical construction of oscillator; Improper control of oscillator voltages.
Overheating	Wrong connection; Insufficient safety factor in component rating; Loss of grid bias (in tubes); Unbalanced drive (to push-pull tubes); Defective component.

Table 1. Usual Causes of Equipment Bugs

CAUSE	CURE
Unwanted resonance	Install "parasitic trap" tuned to unwanted resonance frequency to trap out energy.
Improper oscillator time constant	Reduce either resistance of grid leak or value of grid capacitor until parasitic disappears.
Unwanted feedback	Isolate input and output of amplifier from each other; decouple power leads.
Improper shielding	Shield each stage, leaving no holes and bypassing all leads which pass through shield plates.
Stray coupling	See both Unwanted Feedback and Improper Shielding.
Insufficient isolation	Install buffer amplifier between oscillator and associated stages.
Improper mechanical construction of osc.	Improve mechanical features of oscillator construction; make sure no component is able to vibrate.
Improper voltage control	Install VR-tube or electronic voltage regulator circuit.

Table 2. Cures for Common Bug Causes

Of course, these brief tables can't list every possible bug which may show up in new gear. However, if your own pet bugs aren't listed, you can usually determine the cause and probable cure by applying a little concentrated thought to the problem, once you know the bug exists.

And by following the procedures described here, as a standing operation upon completion of each item of newly built equipment, you'll be certain that you've located all the bugs at no risk to the equipment or to your reputation with the FCC. Good luck, and happy homebrewing! 73

Top Loaded Whip

Al Newland W2IHW
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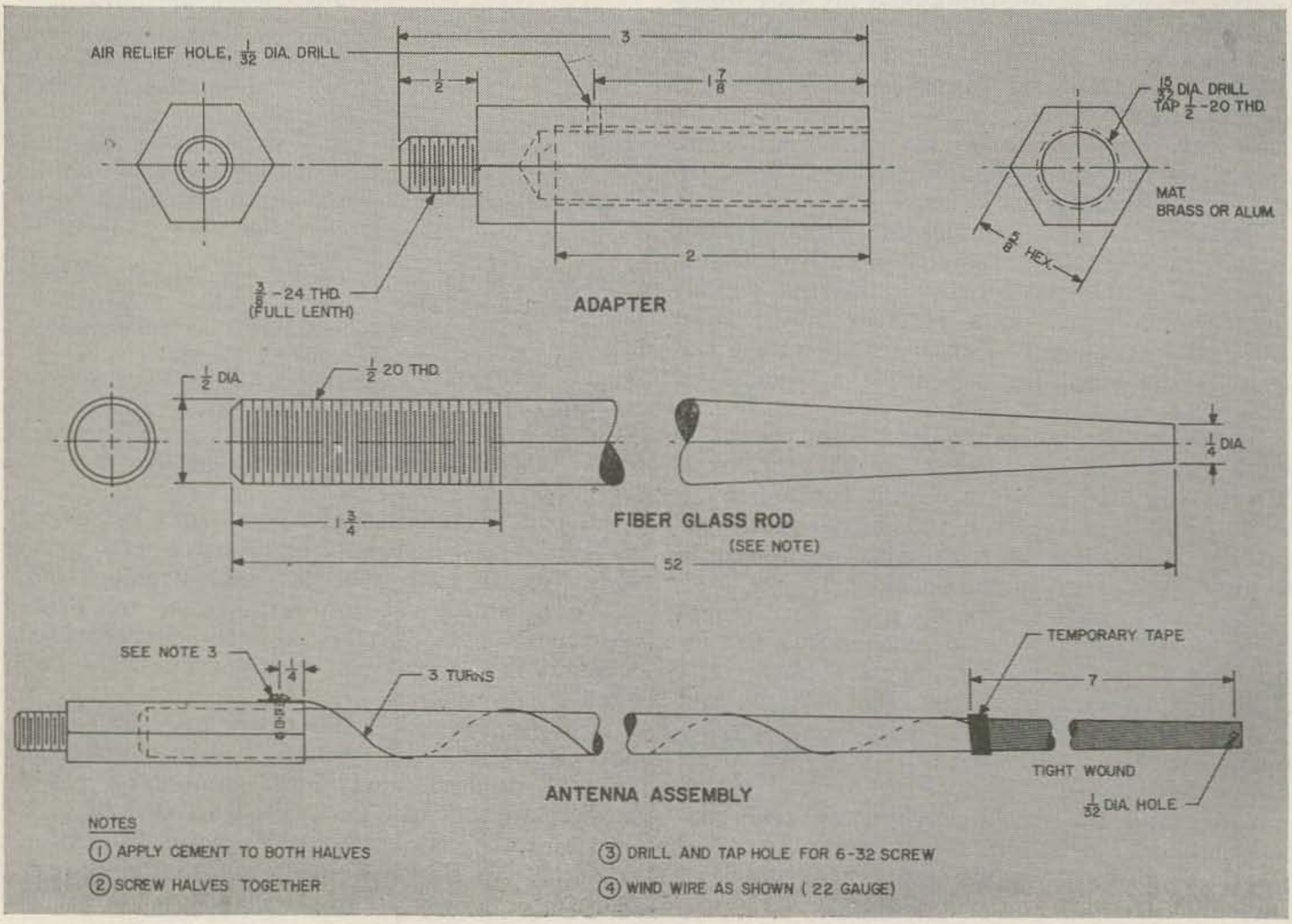
THE interest in short efficient mobile whips is ever increasing. If one can conveniently make his own whip to help cut costs it becomes more interesting. Some added attractiveness lies in the fact that the whips can be selected or cut to the exact length *you* desire. With the proper length to clear your garage door there will be no need to bend it down. If you do not bend it down there will be no need for purchasing a spring or tie down clip. The method of mounting, of course, is quite optional. A method of terminating the fibre-glass rod for attachment to a standard mount is shown in Fig. 1.

If a 52" rod is used (as shown) then a close wound coil 7" long made of No. 22 enameled or Formvar wire is suggested. No pruning of the coil is done on the upper end of the whip so a small hole is drilled as shown to anchor the wire prior to winding. A piece of electronic tape is applied over the last few turns to prevent unraveling and the wire is then extended for the balance of the rod using about a 3 turn spiral. If a rod less than 52" long is used then it will be necessary to start with a longer coil. Scrape insulation from end of wire and fasten securely under screw head. Attach antenna to car and add a jumper wire from the antenna to the car frame as shown in Fig. 2. It is suggested that the coax be removed from the antenna mount when grid dipping.

With an excess of turns in the coil, a frequency somewhat lower than that required for 28 mc will be observed. In order to raise the frequency proceed as follows. Unfasten wire from under screw head, remove turns from the lower end of the coil, pull the wire taut, clip off the excess wire, scrape off the insulation as before and refasten wire under screw head. It will be noted that the dip from this type antenna is quite sharp—so tune carefully.

When the whip has finally been trimmed to

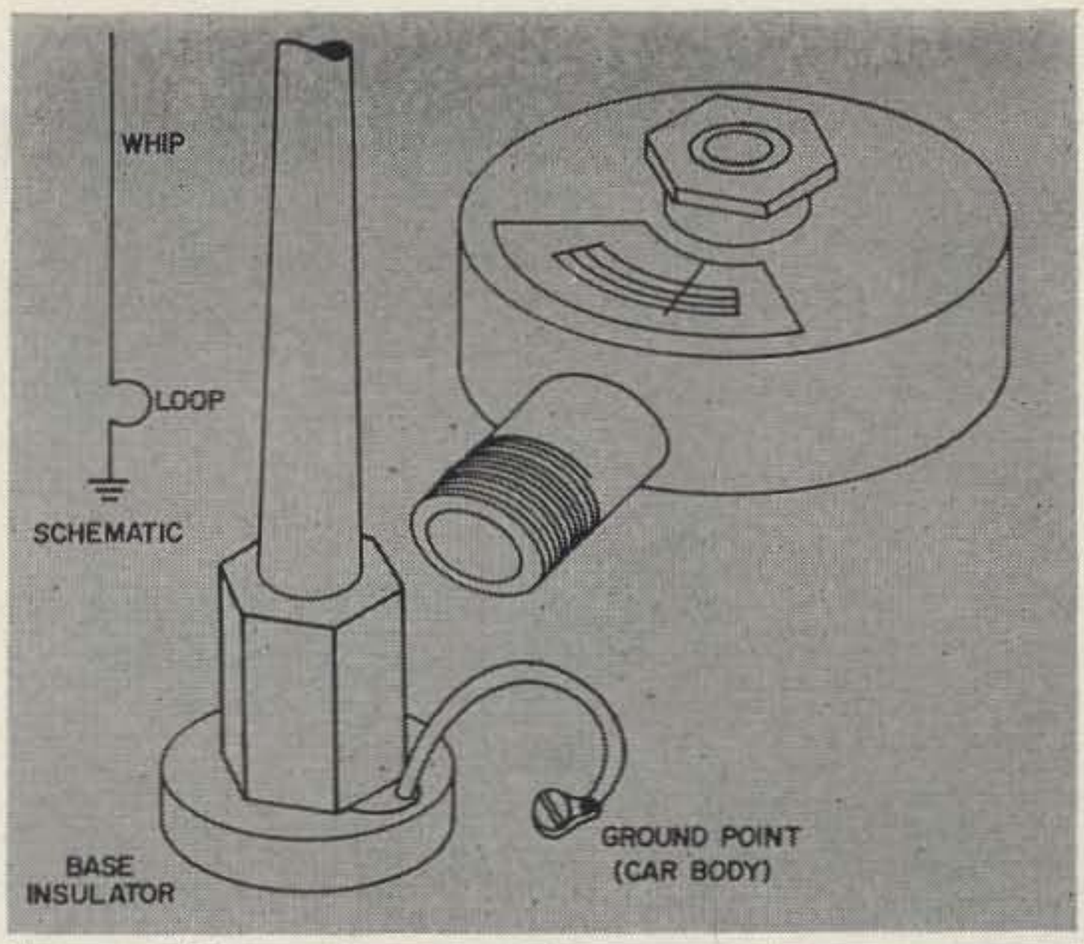


the desired frequency, it will be necessary to coat it with several protective layers of varnish or lacquer. Krylon or lacquer in pressurized cans is very convenient. After the first coat is dried the tape may be removed and the additional coats applied. Allow ample drying time between coats.

The use of this type whip is not limited to 10 meters but may be used on any frequency where a full length is not desirable. A ground plane or beam antenna may be constructed using this type whip. When used on marine equipment, a much neater boat appearance is obtained.

Note: Fibre-glass fishing rod may be purchased from your sports goods store. Available from the writer at $2.00 post paid.

. . . W21HWR



Plugs for the Asking

A short treatise on a fine point in the Scrounge's Art

Staff

ONE major bottleneck in many home construction projects has been location of a convenient octal-base plug which can be fastened to other components.

When just the plug is needed, the old standby, the base of an octal tube, less all glass and cement—works fine. But the plastic base proves difficult, if not impossible, to attach securely to other parts of the project.

There's an easy way out of this problem, though, and it shouldn't cost you much more than a cup of coffee.

It's simply this—transmitting tubes such as the 2E26 and 6146 have a metal-shelled base, made of plated brass, which takes solder perfectly.

If you remove all glass, tube elements and cement from the base of one of these tubes, all you have left is the brass case and a low-loss plug which fits an octal socket—perfect for soldering into a chassis box or flashing copper, and big enough for many receiving accessories to fit right inside.

The only remaining problem is where to locate the tubes. With 6146's going for nearly $5 each, most people are pretty careful about burning them out. Chances are you won't have very many in the junkbox.

But there's a perfect source of supply in virtually any part of the country, if you know where to look. Nine out of 10 commercial two-way rigs such as police, fire, and taxicab radio use either a 2E26 or a 6146 for the final.

Technicians working on these sets must test tubes by substitution, since many of the tubes check out fine on a tester but won't work at 152 mc when they get old. The sour tube goes into the wastebasket.

To find the service shop, check with your sheriff. He's an elected official and usually is friendly to any voter who's civil to him. If you explain what you're looking for—the shop, that is, not the tubes—he'll undoubtedly tell you who works on his radios.

At the shop, try to find the technician in a fairly good mood. This is difficult, and in many cases impossible, since all his customers bring in work which must be delivered yesterday and want it back right now. It's a hard life, as the technician will be only too happy to tell you.

Buy him a cup of coffee—or something stronger, if you and/or he doesn't object (he won't). Sympathize with his troubles. About the time he's thinking you're a friendly sort of fellow, ask him how he ever manages to get rid of the old tubes.

He may prove cagey and think you're trying to put something over on him. Two-way technicians are a nervous breed. But you can prove to him you're not trying to sneak a free tube by bashing the glass out of two or three and telling him you'll be glad to take the remnants away.

Odds are you'll go home with enough weak and dead tubes to keep you in business for months. Who knows, you may even find a job servicing two-way!

And in case he doesn't make you break all the tubes, it will never hurt to run them through a checker somewhere before smashing them.

Most of the tubes which fail in this service still have plenty of life left for frequencies below about 80 mc, and all of them that aren't broken, gassy or burned out have enough poop left to make fine modulator tubes.

So you can get the free tubes, as well as the tube bases you went after. Just don't let the service man know. You may want some more some time.

CW Transmission with Teletype Equipment

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RADIO amateurs in general and many actively engaged in the communications field are apparently not aware that perfect CW code transmission is possible with standard Teletype tape equipment. At the risk of boring the avid RTT amateur, a brief review of basic Teletype theory will be helpful in understanding the method used.

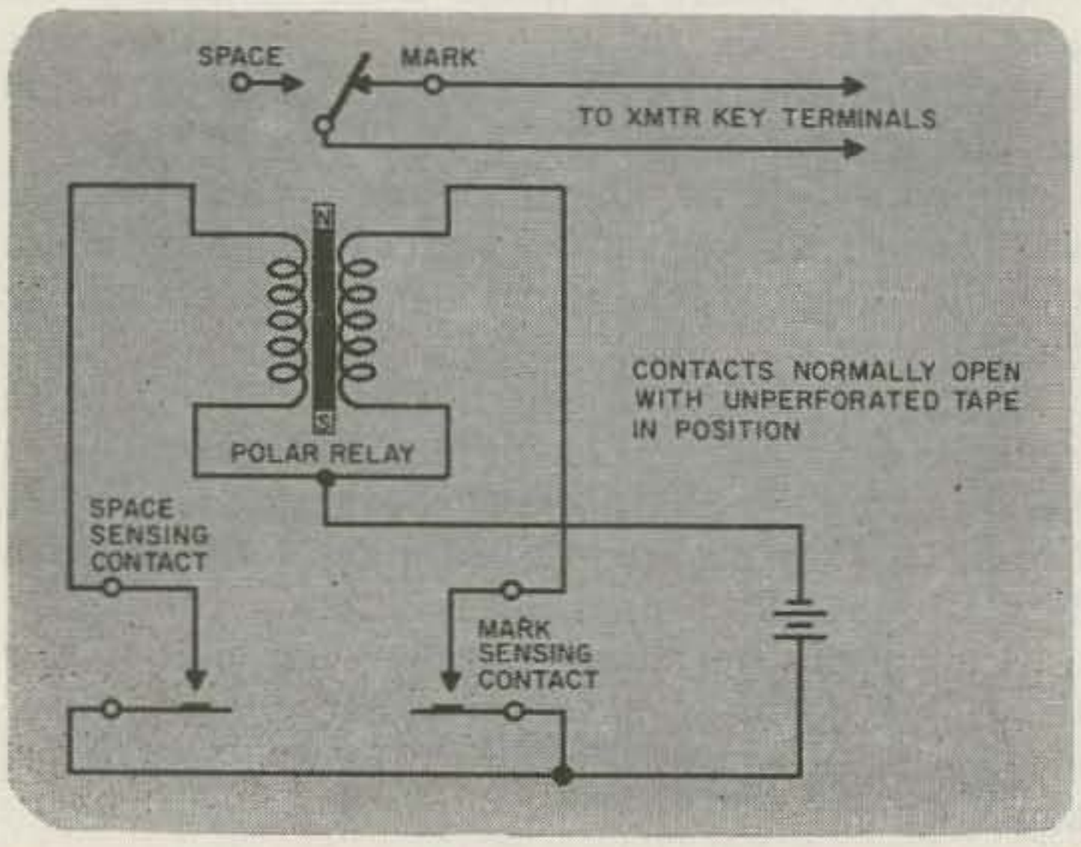
The standard American Teletype code consists of the presence or absence of a total of five code impulses. The teletypewriter keyboard sets up the combination appropriate to the key depressed and this information is sequentially read out by the internal mechanism of the machine and transmitted as a series of electrical impulses. Added to the actual code are the start and stop impulses which are used to effect synchronization between the sending and receiving equipments.

Actual keyboard to page printer communication is rarely used for the passing of traffic for several reasons. Leased communications channels are quite expensive and are usually obtained on a scheduled or call up basis. Since few operators are capable of sustained, error-free operation at the maximum rate of transmission that the system allows, it is more economical to store the traffic in the form of manually perforated paper tape. Then, as circuit time becomes available, the tapes are transmitted by a special tape reading device known as a transmitter distributor or, as it is commonly known, a TD. Tape preparation is accomplished by a perforator which is electro-mechanically linked to the Teletype keyboard or by a reperforator which accepts Teletype signals and simultaneously punches and prints the intelligence on the tape.

The prepared tape has a total of six rows of perforations, five of which constitute the five element Teletype code. The sixth row engages a sprocket in the tape head and is used to advance the tape. The tape head has five sensing pins, one for each element of the code. These pins are linked to associated contacts which close if a tape perforation is sensed. Once the code combination is sensed by the tape head, the distributor sequentially reads out this information. In addition, the distributor adds a space impulse at the beginning and a mark impulse at the end of the code combination. The tape is automatically advanced one set of holes and the distributor makes one read out revolution at a fixed rate of 368 times per minute. This results in a nominal rate of transmission of 60 words per minute.

Enough for Teletype theory and now a look at the construction of International Morse Code. The dot is the basic element of this code and the dash is three times as long as the dot. An interval equal to one dot separates dots and dashes within a character, an interval equal to three dots separates characters within a word and an interval equal to five dots separates words.

By arbitrarily selecting the presence of one element of the Teletype code as a key closed condition and its absence as a key open condition, it would appear possible to form CW characters by punching a series of characters that contain this element for key closed condition and a series of characters that do not



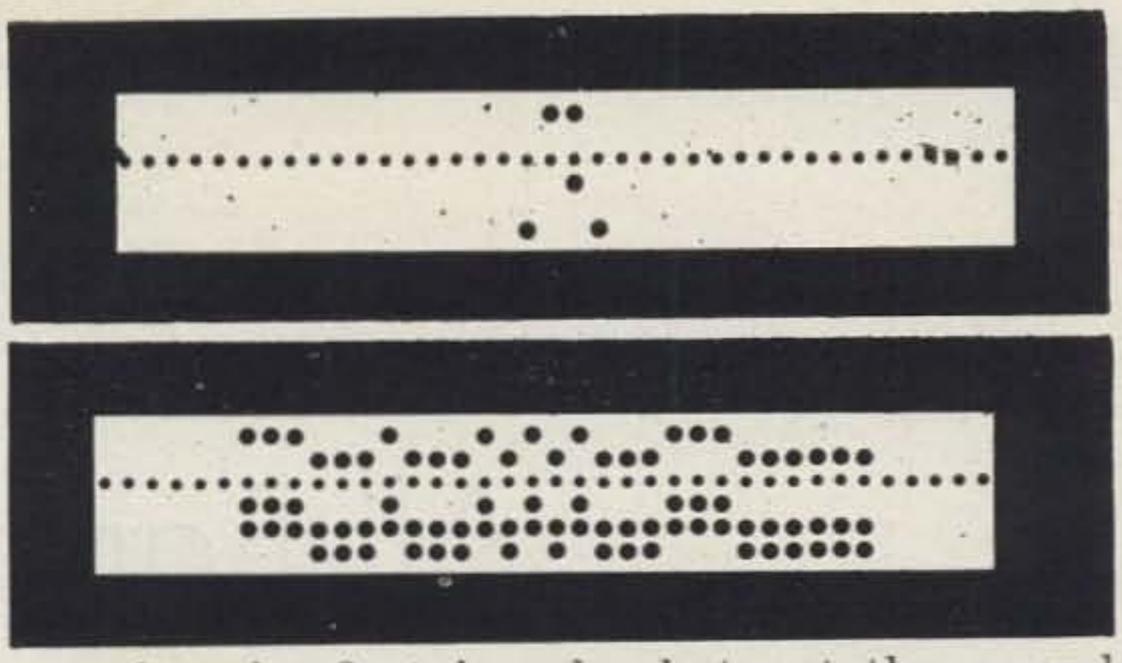
contain this element for key open condition. Dot duration would be one machine operation or 1/368 minute. This is feasible if two additional conditions are met. First, the contact associated with the code element designated as the key closed or mark condition must be isolated from the distributor which introduces the start and stop impulses and also samples the other code elements. The second requirement is that a memory device must be provided which will, during the open contact period of tape advance, maintain the key open or key closed condition set up by the preceding set of perforations.

The polar relay is just such a device. Due to the magnetic latching action inherent in this type relay, it will remain in the position in which it is switched until a signal of opposite polarity is applied to the winding. Further impulses of the same polarity will not change the state of the relay. The same effect may be obtained by selecting a relay with two identical windings and reversing one of the windings. Use of a two winding relay introduces the requirement for the assignment of a second code element to represent the key open condition. This, however, poses no problem since a large number of pairs of Teletype code characters are so constituted that a specific impulse is present in one character but not the other and that for a second impulse the condition is reversed. Fig. 1 shows a circuit that will form CW characters from a series of higher speed pulses.

It is simple to connect the circuit of Fig. 1 to your present tape equipment. Merely run wires from the polar relay to the sensing pins for holes one and two on the tape or to the first two segments on the distributor, which are the same connections. You will want to have a switch in the circuit to return the tape equipment to normal Teletype operation. One contact of this can break one of the sensing connections, one can remove the dc from the relay, and the third can be used to switch the transmitter from CW to the TT connection.

Extra toggle switch mounting holes are provided in most Model 14 bases and one of these may be used to mount the switch. A satisfactory location for the polar relay poses a more difficult problems if the Western Electric 255A is used. The relay socket may be mounted on an outboard bracket or box which may be attached to the TD base or installed in another location. Details will be dependent on station layout and personal preference. Sigma Instruments manufactures a miniature polar relay which is housed in a round, octal based can. This relay, Sigma type 72AOZ-160TS-TCP, is a suitable replacement for the Western Electric unit and is small enough to mount under the TD base.

Tape preparation is simplicity itself. Select two adjacent keys on the second row of the keyboard, chosen so that the one on the left



contains the first impulse but not the second and the key on the right contains the second impulse but not the first. "F" and "G" were chosen by the writer as being most convenient. Depress the "F" key once for a dot and three times for a dash, using the forefinger of the right hand. Using the middle finger of the right hand, depress the "G" key once for the space between dots and dashes, three times for the space between characters and five times for the space between words. Figure 2A shows the word "TEST" perforated in the standard Teletype code on a Model 19 machine. Fig. 2B shows the same word punched for CW transmission.

Signalling rate in the CW mode is limited by the predetermined Teletype equipment operating speed. Assuming five letter groups and using the formulations of W4CF in the recent series of Hallicrafters advertisements on keyers,[1] there are some 52 code elements in a standard five letter group. This includes the character elements and the spaces between character elements, characters and groups. Since each set of perforations (or Teletype "operation") is equal to a code element, this figures as $\frac{368}{52}$ or slightly over seven words per minute on a 60 WPM tape head. A 100 WPM tape head would transmit at slightly over 11.5 words per minute.

Application of this method of transmission, in the stage of development described herein, is limited by the maximum code speed available. Obvious uses of this system are the automatic CW transmission of amateur call identification which is required by the FCC when using RTT, code practice and commercial and military applications where equipment failure or adverse conditions preclude the use of the normal mode of communication.

The most obvious improvement in this system would be to increase the speed of the tape head. This would, of course, prevent the use of the TD for normal Teletype transmission. The motor shaft is geared to a main shaft which revolves once for each character transmitted. Attached to the main shaft is the

(Continued on page 71)

[1]A more comprehensive reference was not available to the writer at the time this article was prepared.

A New All-Band Antenna

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An all-band antenna which gives perfect performance on every amateur band from 160 down to 10 is the dream of almost every ham. Many such devices have been described in the past, but all have represented compromises of one form or another. Some required additional tuners, a few utilized tricky traps, and several flatly failed to live up to their designers' claims.

Here's a new version of the all-band antenna, which offers less compromise than many of its predecessors. It involves no trap circuits, and will work without an antenna tuner (provided your transmitter can tolerate a load which varies between 50 and 450 ohms, always resistive) although use of a tuning circuit will give improved results.

Old-timers will recognize the layout of the antenna (see Fig. 1) as a derivative of the delta match, widely used some years ago to match the then-popular 600-ohm feed line to beam antennas. However, there's a major difference.

This antenna, dubbed the "Exponential Array" by the designer, matches the transmission line to free space.

The general theory employed in its design is a logical outgrowth of that used to develop the Discone antenna, once highly popular and still widely used in commercial circuits. In some respects, also, it is similar to the log-periodic antenna. And before the slide-rule boys rise in arms, we will admit that other theories insist that the thing can't possibly work. A bumblebee can't fly, either, by the laws of aeronautical engineering.

At this point, it should be emphasized that the dimensions shown in Table 1 have been measured and tested. While other dimensions should give equal results, nothing can be guaranteed if either leg length or feed-line length is varied. Don't let this stop you, though. Try it and let us know what happens for you.

The easiest way of building an Exponential Array is to stake out a pattern in the back yard (or a handy city park if no back yard is available). Measure off a line some 25 to 30 feet long, then mark off other lines at right angles to it every foot in a sort of herring-bone pattern. Measure out the proper lengths and stake them.

Now, take your No. 14 wire and stretch it from stake to stake in the shape shown in Fig. 1. Use plastic clothesline for the horizontal stretchers—they're necessary to hold the array in shape once its erected. When spacing gets down to less than a foot, the traditional wax-soaked dowels can be used.

Once built, the array must be raised into position. The original was hoisted to an altitude of some 24 feet and supported by more plastic clothesline at each end. The feed-line was brought off horizontally so that the entire antenna was horizontal to the ground—but equally good or maybe better results should be attainable with the fan pointing skyward.

In theory, the Exponential Array's operation is simplicity itself. As you know, two parallel conductors (the familiar open line or twinlead) won't radiate if current in each is balanced, since the field of one cancels the field of the other. At the same time, the line exhibits a definite characteristic or "surge" impedance which is, in part, a function of the spacing between the wires.

If the spacing is increased (gradually, so that there's no sudden impedance "bump" on the line) the impedance will also increase. The line still won't radiate, so long as the conductors are spaced closer than about one-tenth wavelength.

As the spacing increases past the one-tenth wave dimension, the fields no longer cancel and part of the energy in the line is radiated into space. Another way of expressing the same result is to say that the impedance of space (377 ohms) effectively short-circuits the much higher impedance of the line at this point, and the power flows into the lesser impedance.

From the point at which the line is "short-

ed" by space, on to the end of the array, the wire might as well not be there. Its only function is to support the active portion of the array.

As you can see, the only part of the action which is frequency-sensitive is the point at which the array stops being a line and becomes an antenna. Theoretically, there should be no resonance in such an array, and impedance should be a constant 300 ohms from far below design frequency all the way up to SHF regions.

In practice, it doesn't quite work out this way. Much of the operation is not fully understood, but apparently the array acts as a cross between a dipole and a delta match. Using the dimensions of Table 1 a number of low-Q resonances were found. At these points (located in semi-harmonic relation, see Table 2) the impedance was as high as 450 ohms resistive. In between, the array exhibited mild reactance.

However, at no point in the range from 1700 kc to 30 mc did the impedance vary so widely that the array refused to accept power. When fed by a pi-net output network, the antenna loaded a homebrew final to rated power at all frequencies tried within this range.

At lower frequencies, the antenna is omnidirectional. When the broadside dimension approximates a half wave, the familiar dipole pattern appears. As frequency increases, the pattern approaches that of a V-beam as would be expected.

Incidentally, though no tests were run at UHF, the antenna was connected to the TV receiver—and pulled in Channel 10 from San Diego, some 250 miles to the south.

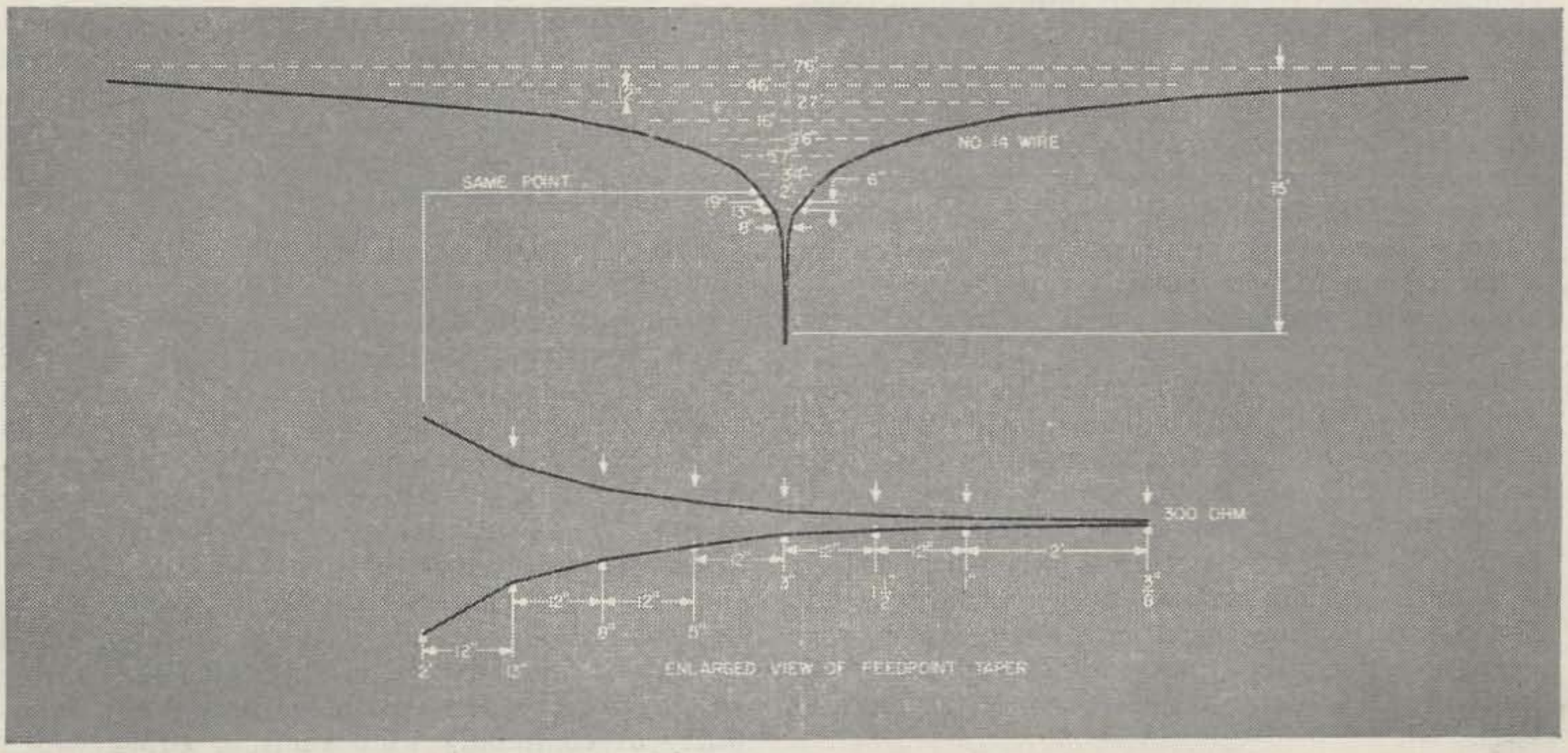
In summary, the Exponential Array offers a new approach to the all-band antenna situation, with promise of attaining the long-sought goal of perfect performance with no adjustments. More study by others is needed to develop full design information. The only claim made by the designer is that the experimental model worked, as evidenced by the measurements tabulated in Table 2. Try one at your QTH, and let us know how it works for you!

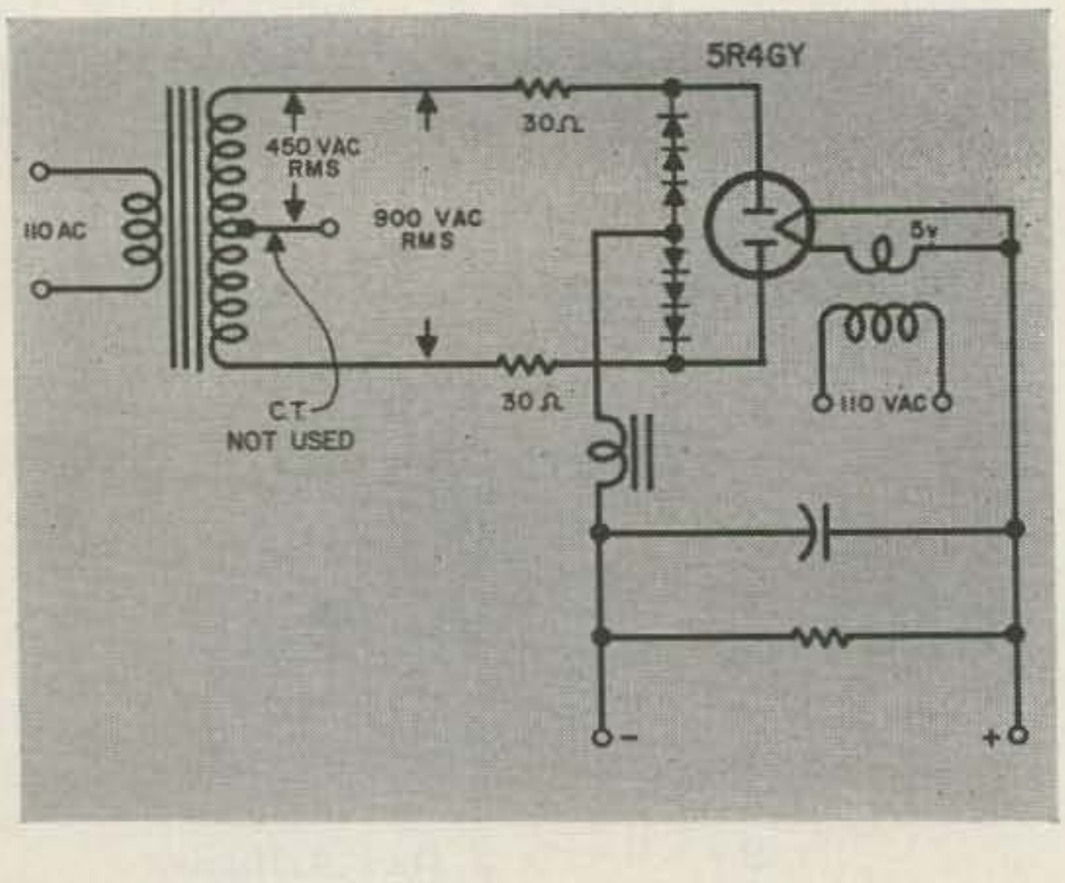
Distance from start (*in feet*)	Spacing
0	⅜ inch
1	9/16 inch
2	1 inch
3	1-11/16 inch
4	2-½ inches
5	4-⅞ inches
6	8-¼ inches
7	13-¾ inches
8	23-½ inches
9	3 feet 4 inches
10	5 feet 7 inches
11	9 feet 6 inches
12	15 feet 10 inches
13	26 feet 8 inches
14	45 feet 10 inches
15	75 feet 10 inches

TABLE 1. Dimensions of Exponential Array made of No. 14 Wire to Match 300-ohm Feed Line.

Frequency	Impedance
2450 kc	300 ohms
3850 kc	50 ohms
4900 kc	450 ohms
7500 kc	75 ohms
10 mc	50 ohms
15.25 mc	75 ohms
21.0 mc	125 ohms
27.5 mc	450 ohms
27.9 mc	200 ohms
28.1 mc	200 ohms
29 mc	450 ohms

TABLE 2. Variations of Impedance of Exponential Array of Fig. 1 with Variations in Frequency; measured with Heath Impedance Bridge and Grid-Dip Oscillator.





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A Different Approach

Doubling Your Power Supply Voltage

THERE are many times when it should be advantageous to double your power supply voltage, particularly when you have a project to build a linear amplifier for SSB, or change amplifier tubes to higher voltage and lower current for greater efficiency, yet would like to use the same power supply. The purpose of this article is not the construction of a particular piece of gear to be followed implicitly, but to suggest a method anyone may employ to fit their particular power supply problem.

The classic method in voltage doubling for transmitter supplies has been to employ the well known bridge rectifier circuit. Voltage doubling by the capacitor method has not been so popular when voltages really get up there due to regulation problems and the need for such large electrolytic filter condensers. Particularly when such good oil impregnated types are plentiful and relatively cheap and reliable. A major disadvantage of the bridge circuit is the four rectifying elements required and the three heater or filament sources. When you have an existing power supply, the addition of two more rectifier tubes and two more high voltage breakdown filament transformers, or a triple transformer, usually represents impossible space problems as well as a high cost factor.

To rip out the rectifier tubes in your supply and replace them with silicon rectifiers at first glance appears to be the solution, however this approach costs a lot of money today and it seems foolish to throw away usable rectifying capability. A hybrid power supply—half silicon and half rectifier tubes—appear to represent the happy medium as a solution of space and economy. Many existing supplies could use this method with a minimum of construction and cost.

The reader should not be lulled into forgetting the requirements for *any* method of altering a power supply to double your voltage output. Here are the key factors;

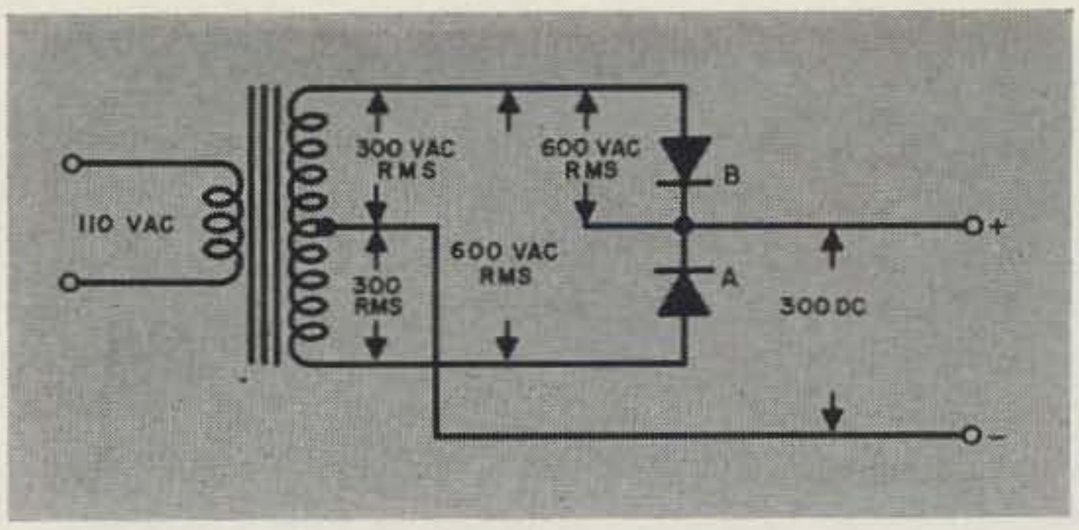
1. Be sure the rectifier filament winding insulation (and tube or tubes) will stand the new double peak voltage.
2. When the voltage output is doubled, the current will be halved. Your gain is through the use of amplifier tubes which are more efficient at the higher voltage. The amplifier input wattage may be no higher, but the output probably will be.
3. Your filter choke or chokes must stand the higher voltage breakdown required. A common "dodge" is to put the choke in the negative lead.
4. Your filter condensers must be replaced or be capable of withstanding the new higher voltage.
5. The bleeder resistor must also be of the proper value to meet the needs of the higher voltage.

Fig. 1 illustrates a hybrid power supply. Note the surge resistors to limit current. These are usually from 5 to 30 ohms, depending upon filter capacity, and are placed in each leg of the power transformer secondary. A word about silicon rectifier ratings to be used would also be in order. A full wave circuit with 250 ma rectifiers would yield 500 ma, which is usually enough for most amateur applications. These sizes would be much cheaper, of course, than the 750 ma variety which, for example, would give you 1.5 amperes. However, nothing could be gained in a hybrid circuit with the larger rectifiers since this would be beyond the capability of commonly used rectifier tubes which

would be in the other half of your rectifier system.

There also appears to be much confusion as to rms and piv ratings to be used. I have often heard people express the belief that advertised values were incorrect. The error, I think, originates with the user. Fig. 2 is a simplified full wave schematic drawn to illustrate this point. When rectifier A is conducting, the *full* secondary voltage appears across rectifier B. This means that although you may have a simple 300 volt supply, *600* volts appears across each rectifier on alternate cycles, not 300! The moral is to be sure that the rms value of *each half* of your rectifier string will more than meet the *full* rms value of the transformer secondary, not one-half to the center tap.

The use of this hybrid method should become popular. Among the suggested conversions are



to change 750 volt supplies to 1500 volts for 811A's or 2000 volt supplies, at which voltage 4-250A's and 4-400A's are notoriously inefficient, to 4000 volts. The space saved by this application will readily strike the prospective user and make possible a conversion that may have not otherwise been considered feasible.

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Impedance Matching in Surplus Equipment

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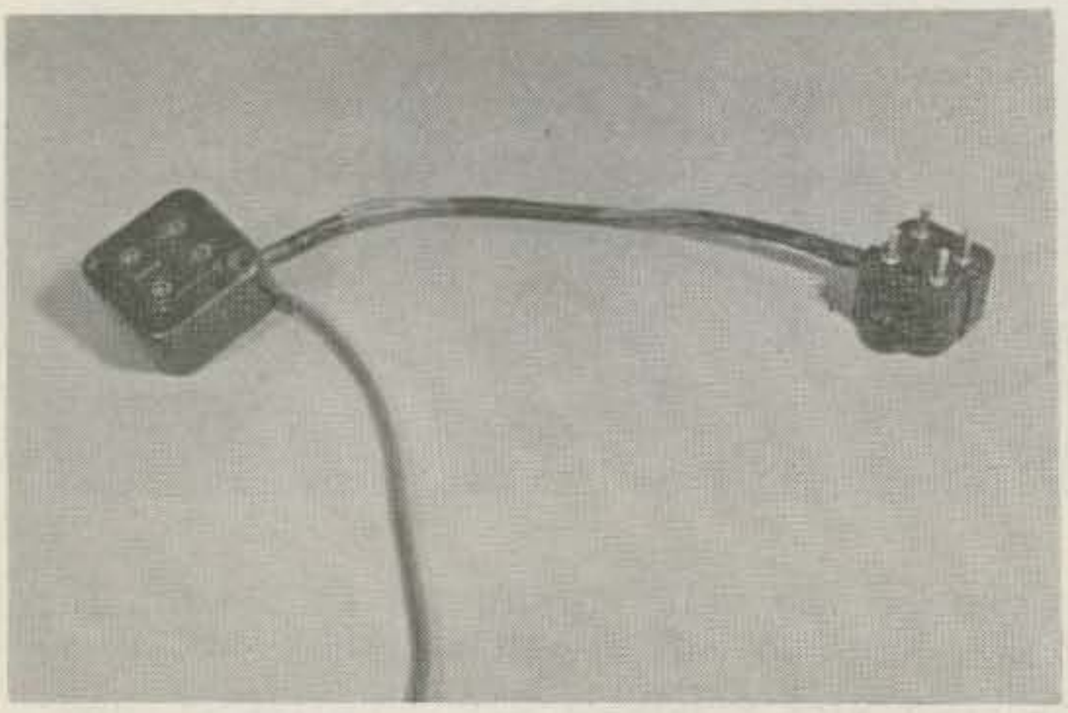
THE INPUT and output impedance of military equipment is often unknown to the person considering amateur application of these items. Impedance matching is important and the use of matched audio accessories will do much toward correcting the fairly common and often unjustified complaint of insufficient audio gain.

The chart lists a number of surplus radio equipments and their audio input output impedances.

Impedance variations in transmitter input circuitry are not too great and in most instances match either a carbon microphone or a 500-600 ohm line. On the other hand, receiver output impedances vary widely and more or less unpredictably. Since it is usually desirable to effect a minimum number of internal equipment changes, consideration should be given to the use of external line matching transformers. Small commercial units are available to meet a wide range of impedance matching requirements and these transformers will often mount directly on the loudspeaker frame.

Careful attention to impedance matching requirements will result in improved performance of surplus conversions and use of external, speaker mounted line matching transformers will minimize the work in such projects. The results more than justify the expense.

Radio Set	Transmitter	Receiver	Trans. In	Rec. Out
SCR-177-B	BC-191-C	BC-314-C	35 to 200	4,000
SCR-188-A	BC-191-C	BC-342-C	35 to 200	4,000
SCR-193-( )	BC-191-C	BC-312-C	35 to 200	4,000
SCR-399-A	BC-610-E	BC-312-( )	200	4,000
		BC-342-( )	200	4,000
SCR-499-A	BC-610-E	BC-312-( )	200	4,000
		BC-342-( )	200	4,000
SCR-506-A	BC-653	BC-652	200	8,000
SCR-508-( )	BC-604	BC-603	200	8,000
SCR-528-( )	BC-604	BC-603	200	8,000
SCR-509-A	BC-620	BC-620	200	250 or 4,000
SCR-510	BC-620	BC-620	200	250 or 4,000
SCR-543-( )	BC-699	BC-699	100	100
SCR-608-A	BC-684	BC-683	200	8,000
SCR-628-A	BC-684	BC-683	200	8,000
SCR-609-A	BC-659	BC-659	200	250 or 4,000
SCR-610-A	BC-659	BC-659	200	250 or 4,000
SCR-619-( )	BC-1335	BC-1335	200	250 or 4,000
SCR-694-C	BC-1306	BC-1306	160	250 or 4,000
SCR-808	BC-923	BC-923	200	8,000
SCR-828	BC-924	BC-924	200	8,000
AN/TRC-1-( )	T-14-( )/TRC-1	R-19-( )/TRC-1	500	500
AN/TRC-8	T-30/TRC-8	R-48/TRC-8	500	500
AN/PRC-8-10	.....	.....	150	600
AN/GRC-3-8	.....	.....	150	600
AN/GRC-9	RT-77/GRC-9	RT-77/GRC-9	160	250 or 4,000



Patch
Patch

Allie C. Peed, Jr. K2DHA
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Rochester 20, N. Y.

ALL of the articles and instructions on phone patches end up by directing you to connect the line terminals of the patch to the red and green leads in your telephone's junction block. This leaves you more-or-less on your own from there on. As you can readily imagine, most telephone companies take a very dim view of anyone not in their employ connecting or disconnecting anything in their installations.

So, in spite of this, you're determined to have phone patch facilities (after all, other people have them) and you are willing to bear the possible wrath of the telephone company. If you take the step and are permanently connected, then in case of trouble on your line, the serviceman is likely to discover your connection, cut it off, report it to the company and blame you for any trouble on the line. Thus can begin a first-class rhubarb with you in the role of underdog.

Wouldn't it be better to have a patch installation which could be connected to the line by a plug-in connector and which could be plugged in when you want to run a patch and taken out when not needed—all of this to be accomplished without making any unauthorized changes in the telephone installation itself?

Fortunately, this is fairly easy to accomplish. The key to the whole thing is to have the telephone company install extension jacks in your house. For a small installation charge they will fit jacks at any and all locations where you might wish to plug in the telephone in your house. This doesn't add to your monthly billing. There is only the one-time-only installation charge. However, you must have at least two jacks installed.

Once the jacks are installed, you can unplug your telephone and plug it in at any jack in the house. Thus, when you want to run a patch, you can simply go and get the telephone and plug it in at the operating position.

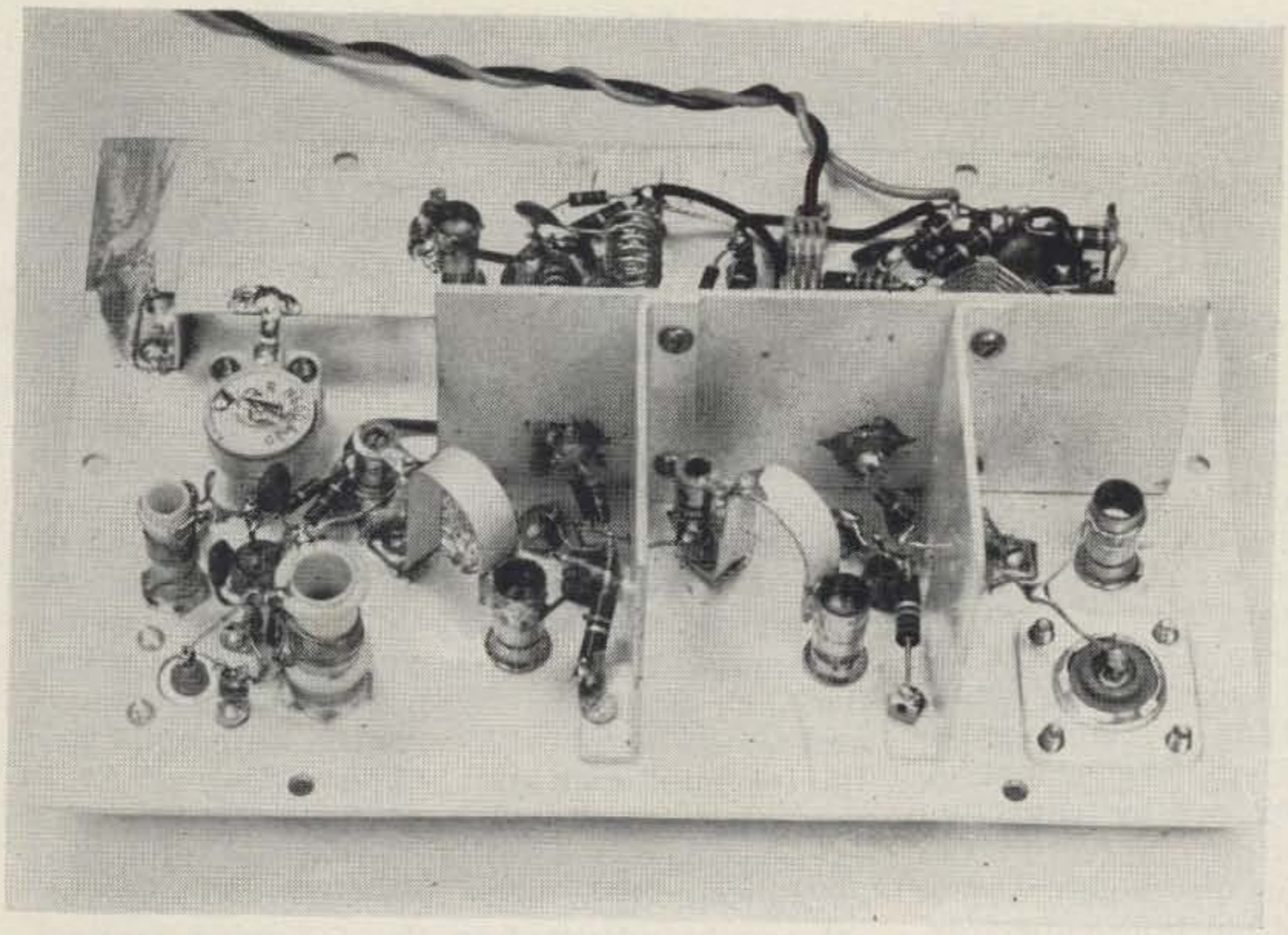
Make up a patch cord with your phone patch connection in the cord. Plug this cord into the jack and plug your telephone into the other end of this cord. When you are finished, put your patch patch cord back in a drawer, return your telephone to its regular resting place and there is no sign of your installation.

Unfortunately, the telephone company uses a rather odd type of four-pronged jack in its extension installations and these have until recently been hard to come by unless you had a friend at the telephone company. Recently, Olson Radio in Toledo, Ohio has started to market these plugs and jacks and a patch patch cord is practical for all now.

All that you need are one male and one female telephone extension jack connectors, a few feet of three wire cable and a few minutes of your time. The screw terminals in both the jack and the plug are marked with the color of the leads. Be sure to connect a wire between the terminals marked similarly, i.e., red to red, green to green, and brown to brown. Make this wire as long or as short as you need for your convenience in placing the telephone and phone patch unit at your operating position. The jack is made for surface mounting with two screws and can be mounted permanently on the desk by the rig if you choose.

Then, in either the plug or jack of your patch patch cord, connect the two line leads from your phone patch unit to the terminals marked red and green respectively. This can be a permanent type connection since the whole patch patch cord can remain at the operating position connected to the phone patch unit.

It's simple to use. Just plug the male end of the patch patch cord into the extension jack installed for you by the telephone company. Then, plug your telephone instrument into the female jack on the other end of the patch patch cord and run your patch traffic. When you are finished, merely unplug and store your patch patch cord and return the telephone to its usual position. Neat, eh?



A 432-436mc Transistor Converter

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THIS article presents a fully transistorized converter operating in the 432 to 436 mc frequency band. It employs a crystal controlled local oscillator to improve frequency stability. A communications receiver capable of tuning the 28 to 32 mc range is used for the *if* system. It features an overall power gain of 31 db with a noise figure of 7.1 db. The 3 db bandwith was measured to be five megacycles.

The UHF spectrum presents a new challenge in the use of transistors. There has been very little in the way of published material on the usage of the transistors at these frequencies.

This converter was constructed with the idea of determining how effective transistors would be in functions previously accomplished by the use of vacuum tubes. The Philco small area MADT* transistor was selected because of its superior performance in the VHF spectrum.

The result was a 432 mc converter whose operation surpasses that of most tube types. Compactness and low power requirements make the transistors even more desirable.

*Trademark—Reg. U.S. Pat. Off.

RF Section

The two RF stages are operating as common-base amplifiers and the mixer as a common-emitter stage. A series capacitor, C2, couples the signal from the antenna to the emitter of the first RF amplifier stage. A variable capacitor, C1, is inserted between the input and ground. In operating an amplifier common-base, there exists some inphase feedback from the output back to the input circuit through the transistor. C1 is adjusted to minimize any tendency towards instability resulting from this feedback.

The output circuit is tuned by capacitor C3 and coil L1. A coupling capacitor C4 feeds the output to the emitter of the second rf stage. The output of this stage is tuned by capacitor C5 and coil L2. A coupling capacitor, C6, feeds the signal to the base of the mixer. A 30 mc trap is inserted between the base and ground of this stage. This trap short circuits the input admittance of the mixer at 30 mc providing higher conversion power gain. The output is coupled to the load through a

30 mc transformer consisting of coils L5 and L6.

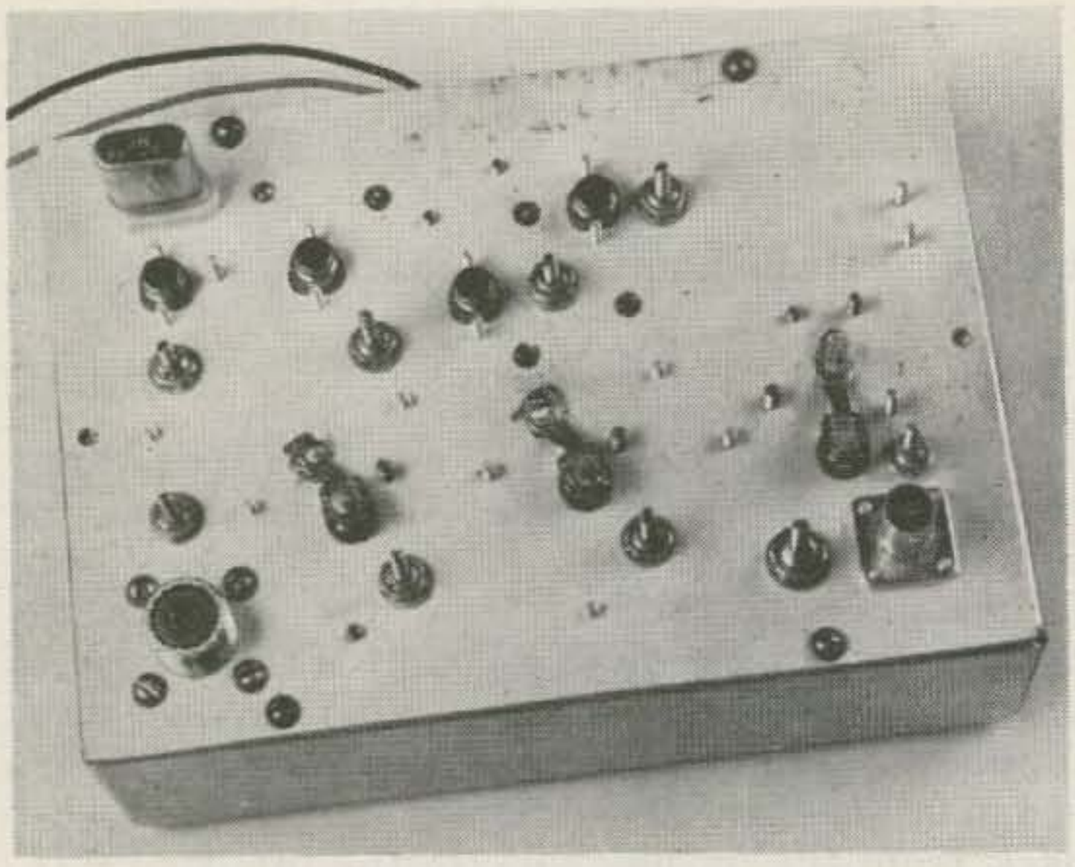
The local oscillator signal is injected into the emitter through capacitor C7. Coil L4 provides a high impedance at the local oscillator frequency and forms part of the emitter bypass network for the *if* signal.

Harmonic Generator

The first three stages are operating as common-emitter stages. The last stage is used as a grounded base doubler.

A crystal controlled oscillator is used for frequency generation. Capacitor C8 and coil L7 tune the output to 50.5 mc. A 6.8 mmfd capacitor matches the output to the base of the first frequency doubler. The output of this stage is tuned to 101 mc. An 8.2 mmfd capacitor matches the output to the base of the second frequency doubler. The output of this stage is tuned to 202 mc by capacitor C10 and coil L9. The output is fed to the emitter of the third frequency doubler by a tap on L9 and a 100 mmfd blocking capacitor. The output of the last stage is tuned to 404 mc by condenser C11 and coil L10. Capacitor C7 couples the power to the emitter of the mixer. C7 is peaked for maximum drive into the mixer.

The resistors located in the emitter circuits of the transistors provide the necessary dc stabilization. The others form bias networks to fix the operating point.



Construction

The photographs and coil data should assist in the construction of the converter. A 7 x 5 inch brass stock 1/16 inch thick serves as a mounting plate for the components. An aluminum chassis 7 x 5 x 2 inches serve as a shielded enclosure. Although silver plating the brass is recommended, it is not necessary. Good ground connections are necessary for proper operation.

Tuning Procedure

It is first desirable to align the harmonic generator stages to the proper frequencies. A wave meter/grid dip oscillator is very useful. In grid dipping the tank circuits, it is recommended that the transistors are removed from their sockets. Capacitor C7 is set to a mid value and then can be peaked up later.

Next, tune the output coil of the mixer to 30 mc. The 30 mc trap in series with the mixer base and ground should be disconnected during this tuning procedure. After the 30 mc output coil is aligned, the trap is resoldered back into the circuit. The trap is set with a grid dip oscillator by removing the mixer transistor and inserting a short between the emitter and base terminal. The slug of L3 is now adjusted for a dip at 30 mc. Remove the short and replace the mixer transistor.

A signal generator is very helpful in aligning the RF stages. With C4 set at maximum and C6 to about mid capacity, adjust C3 and C5 for maximum gain. The setting of C1 is not critical and can be left out if the first rf amplifier shows no sign of breaking into oscillation. If a noise generator is available, C1 can be adjusted in the following manner. Starting from minimum capacity, vary it until the noise figure begins to increase, then back off about one turn. At the point where the noise figure starts to increase, the power gain is decreasing rapidly due to a decrease in the regeneration of the first stage. As the gain of the first stage drops below a certain value, the noise contributed by the second amplifier stage is on the increase, hence the overall noise figure becomes higher.

Chart I indicates the current drain of the converter.

Chart I

Stage Current Drain (ma)

1st RF	2nd RF	Mixer	Xtal Osc*	Doublers 1st*	Doublers 2nd*	Doublers 3rd*	Total drain	Current (Bleeder I included)
1.5 ma	2.0	2.0	2.0	2.5	3.0	3.0		20.5

*Note—Includes dc bias current.

Driving power also influences the current flow to some extent.

The high gain characteristics of the front end results from regenerative amplification due to the common-base operation. Equivalent gain figures can be had by using slightly over neutralized common-emitter stages. Neutralization above 400 mc becomes difficult. Despite this, the overall 3 db bandwidth is over 5 mc with good stability. One disadvantage of a common-base amplifier is that power gain and bandwidth varies considerably with transistors. Tabulated below are some gain and bandwidths that were observed using a number of transistors.

Overall Power Gain	Overall 3 db BW	NF using L1262A diode	NF using 5722 diode
22—31 db	8—5 mc	6.5 to 8.2 db	5.2 to 6.8 db

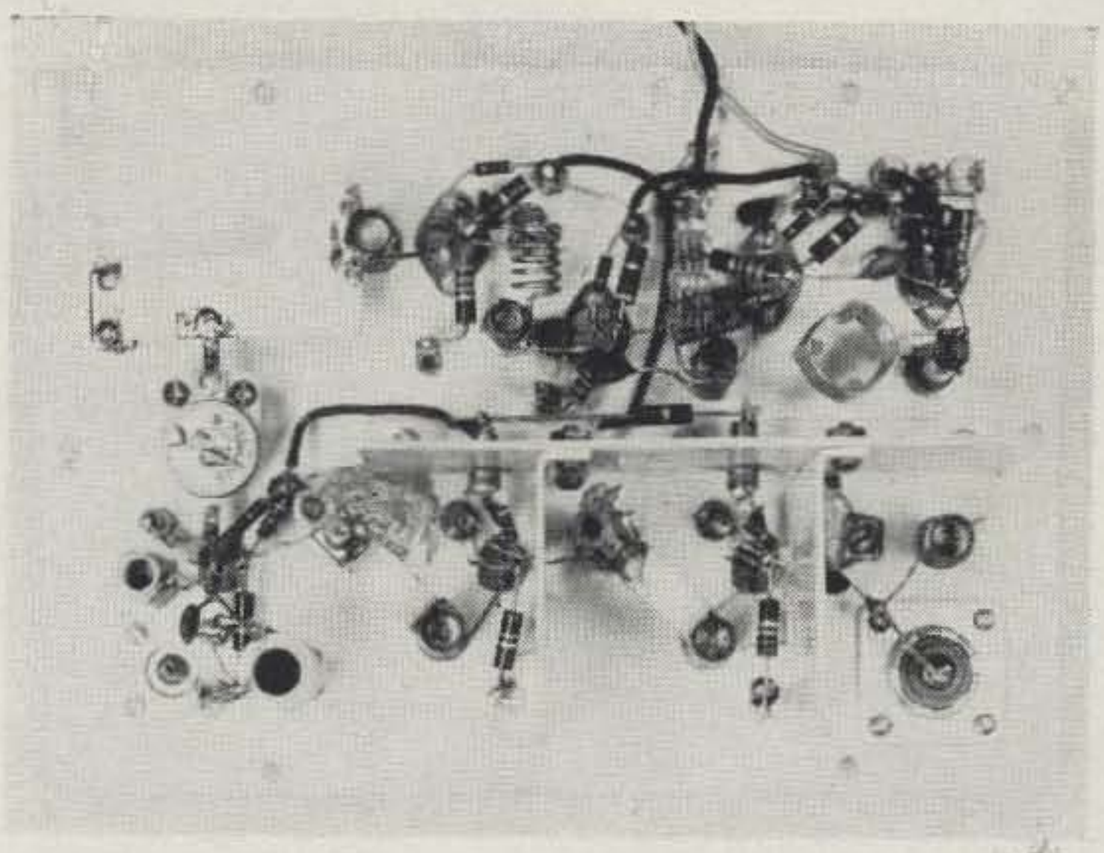
The reason that the noise figure readings are given from two types of noise generators is that the 5722 noise diode is still used by some in determining noise figure. The lead inductances of the 5722 at this frequency tend to produce a better noise figure than the stage really exhibits. A commercial unit produced by the Hewlett Packard Company employs a L1262A noise diode as its generator. The readings using this type of diode produce a more accurate reading. The Hewlett Packard noise diode is guaranteed accurate to 600 mc.

Parts List

C1, C3, C5, C11—0.5-5.0 mmfd Piston Capacitor JFD VC5
C4, C6—1.0-9.0 mmfd Piston Capacitor JFD VC9
C7—7-45 Ceramic Trimmer
C8, C9—1-18 mmfd Piston Capacitor JFD VC4-G
C10—0.5-8 mmfd Piston Capacitor JFD VC1-G
Xtal—Overtone Xtal Petersen type Z-9A

Coil Data

L1, L2—Made up from 2½" x ¼" brass stock 1/32" thick, silver plated.
L3—14 Turns #28 Nyclad copper wire close wound on ¼" form (Cambion type LS-6 with powdered iron core #20063-0).

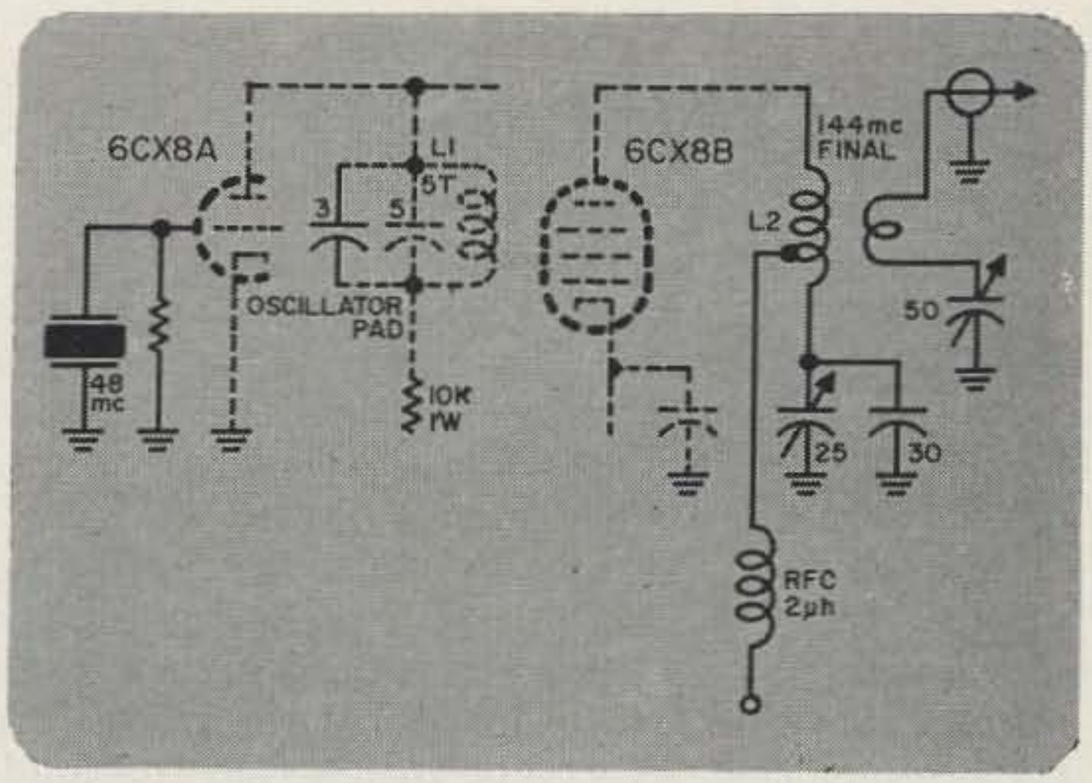


L4—1 Turn #22 tinned copper 3/16" inside diameter.
L5—18 Turns #28 Nyclad copper wire closewound on ⅜" form (Cambion type PLS5-2C4L with powdered iron core #20063-N).
L6—3 Turns #28 Nyclad copper wire closewound over ground end of primary winding L5.
L7—10 Turns #20 tinned copper ½" inside diameter, ⅝" long (B & W Miniductor #3003, Airdux #416T).
L8—3 Turns #20 tinned copper wire (B & W #3003).
L9—5 Turns #18 tinned copper ¼" inside diameter, ½" length, tap 1¼ Turn from ground end.

Converting the Tube Tube Tube, Watt Watt Watt Watt, Meter Meter Meter Meter to the Tube Tube Tube, Watt Watt, Meter Meter

HERE is a quick way to get on 2 with the least amount of effort and dough ray me. It is amazingly simple and quick. First of all look up the first "73" issue (Oct. '60) and on page 32 you will find a little 6 meter rig by the author. Only 3 modifications need be made to convert this rig to 2 meters. This should be an excellent project for the Novice who would like to take a crack at this VHF band. If the instructions are followed carefully there should be no problems such as getting on the right frequency.

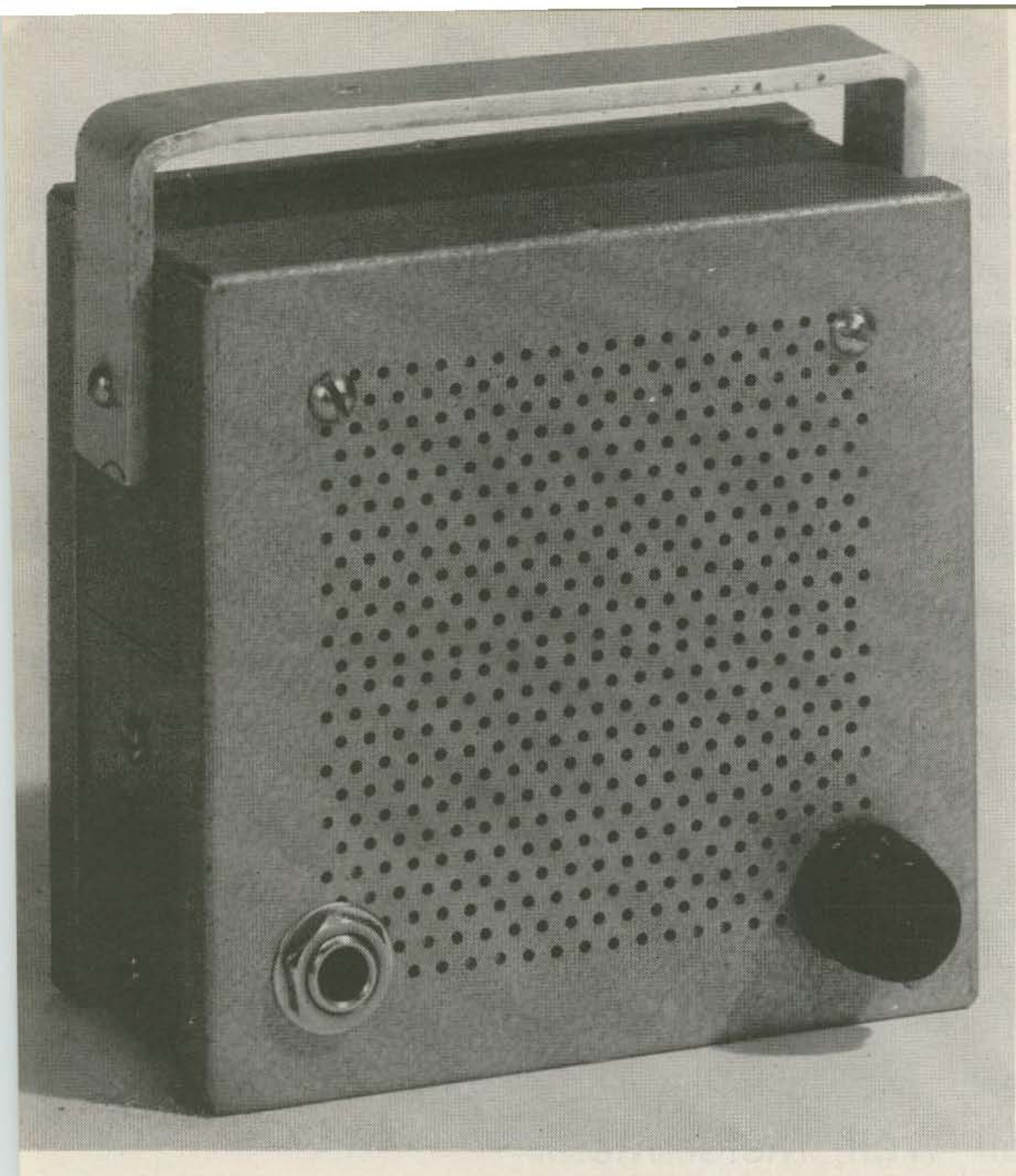
The first thing needed is a 48 mc third overtone rock. For the Novice approximately 48.5 mc is needed which will have a final frequency of 145.5 mc well in the Novice band.



The coil modifications to be made are the following; Add a 3 mmfd capacitor to L1 parallel to the 5 mmfd to reduce the oscillator resonant frequency. Take a piece of #14 wire and wind 4 turns ¾ inches in diameter. Remove the 6 meter final coil L2 and install the 4 turn coil in series with the plate of the 6CX8(B) and the 25 mmfd variable capacitor. Pad the 25 mmfd capacitor with a 30 mmfd. Make a 1½ turn antenna coupler coil from a piece of solid hookup wire ¾ inches in diameter. Place the antenna coupler coil L3 between turn 1 and 2 from the plate end of the final coil. Solder the 2 μh RFC choke 1 turn from the capacitor end.

Now the power can be turned on and tune'er up. The tuning procedures are the same as with the 6 meter rig.

Since the frequency is tripled in the final it is not the most efficient 2 meter rig, but you can have a lot of fun getting on the air. It's fine for local rag chewing. Better results can be expected if a shield is used between the oscillator and final. . . . K8NIC/5



Transistorized Loudspeaker

(Actual Size)

Squawk Box

Jim Kyle, K5JKX/6

A SURPRISING amount of excellent equipment, much of it virtually ready to use, is still available in surplus throughout the country. For VHF and/or mobile use, especially, surplus stocks still prove a gold mine.

And since conversion of the standard auto voltage from six to 12 volts, the same as the long-established military standard, many items require no conversion before installation. No conversion, that is, except to provide for loudspeaker operation. . . .

Almost every military use for the equipment required headphone output; virtually none of the mobile-adaptable gear now to be had was originally equipped to drive a speaker. But phones are inconvenient, to say the least, in the amateur mobile service.

The simple way out of this problem is not to convert the equipment at all, but to add an outboard power amplifier. Since the transistor works excellently at 12 volts, its use is a natural. But this is *not* just another article on how to build a transistor audio power amplifier—it introduces a completely different type of audio output circuit, which can only operate with transistors. In addition to the four transistors, though, you need only two resistors, one transformer (for input, not output!), and the speaker itself. A power amplifier can hardly be simpler than that.

This amplifier operates on the bridge principle, thereby eliminating any dc from the loudspeaker while still doing away with the output transformer. A simplified schematic is shown in Fig. 1, with the transistors represented by variable resistors. Assume that the setting of each resistor is accomplished automatically by the input signal as shown by dotted lines: a positive-going input increases the resistance while a negative-going input reduces resistance.

If, at the beginning, all resistors are set to the same value, the bridge will be perfectly balanced and no current will flow through the

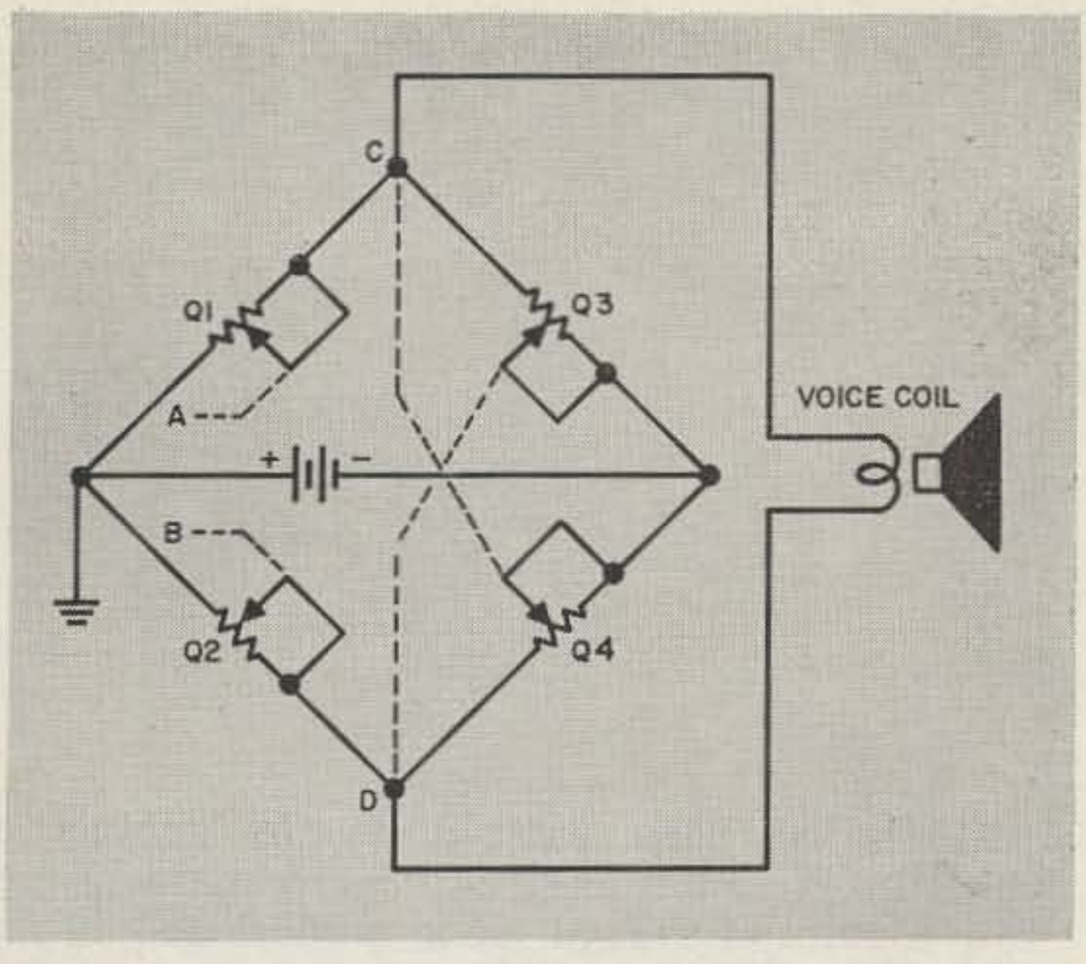


FIG. 1. Basic bridge amplifier, simplified schematic diagram. See text for details of operation.

voice coil.

However, if the voltage at input A goes negative while that at point B goes positive (both voltages referred to ground potential), then Q1 will decrease in resistance while Q2's resistance increases. Forget Q3 and Q4 for a moment—even without them the bridge is no longer balanced. This makes the voltage at point C less negative (or more positive) than it was at balance, while the voltage at point D goes more negative than before.

Now look at Q3 and Q4. They derive their resistance-control inputs from points D and C, respectively. As point C goes more positive, the resistance of Q4 increases. At the same time, with point D going negative, Q3's resistance drops.

This action pushes the bridge even farther out of balance, with resistance of both Q1 and Q3 lowered and Q2 and Q4 increased. Current flows from point D to point C, through the voice coil.

The action just described takes place on each cycle of audio frequency power, and the same action with reversed polarity occurs on the other half-cycles. As a result, the current through the voice coil is that of the af waveform applied to the input terminals.

During this action, each transistor is acting more like the automatically-variable resistor we have assumed for explanation than it is acting like an amplifier. Its resistance will vary from approximately half an ohm as minimum to a maximum of several thousand ohms.

This means that current flow through the voice coil is limited, not by the transistors, but by the impedance of the voice coil itself. To be more exact, this circuit is capable of producing approximately 18 watts in an 8-ohm speaker, or 36 watts in a 4-ohm unit, provided only that the transistors are capable of handling that variety of power.

The unit shown in schematic form in Fig. 2 isn't that powerful. It was built for the express purpose of bringing output from a BC-1306 up to speaker level for mobile use. Its power is approximately half a watt, using type 2N107 transistors.

To protect the transistors from overload, the input was deliberately mismatched. Since the case containing the speaker and amplifier was also to serve as the control unit for the BC-1306, the 500-ohm gain control, microphone jack, and switch (visible in the photos) were added. A six-wire cable connects the squawbox to the trunk-mounted 1306.

Construction of the unit is simplicity itself. The transformer, transistors, and resistors are first mounted on the cardboard chassis and all interconnections are made. Power, input, and output leads are brought out with stranded hookup wire, and the chassis card is then attached to the back of the speaker with two 8-32 screws. Input leads are connected to the gain control, output leads to the speaker voice coil, and the proper power lead (depending on polarity of your car's ignition system) is run to the power switch. The other power lead is grounded.

To use the unit in a non-mobile application, just add a small battery (anything up to 30 volts is fine; the transistors are effectively in series, so maximum-voltage ratings won't be exceeded) and you're in business.

To adapt this gadget to higher-powered use, simply match the input impedances of the first two transistors (Q1 and Q2) for maximum power transfer, and supply enough driving signal to push them to saturation. Presto, power! Values of the two resistors might be trimmed in either direction for maximum power output, also—it didn't prove necessary here. 73

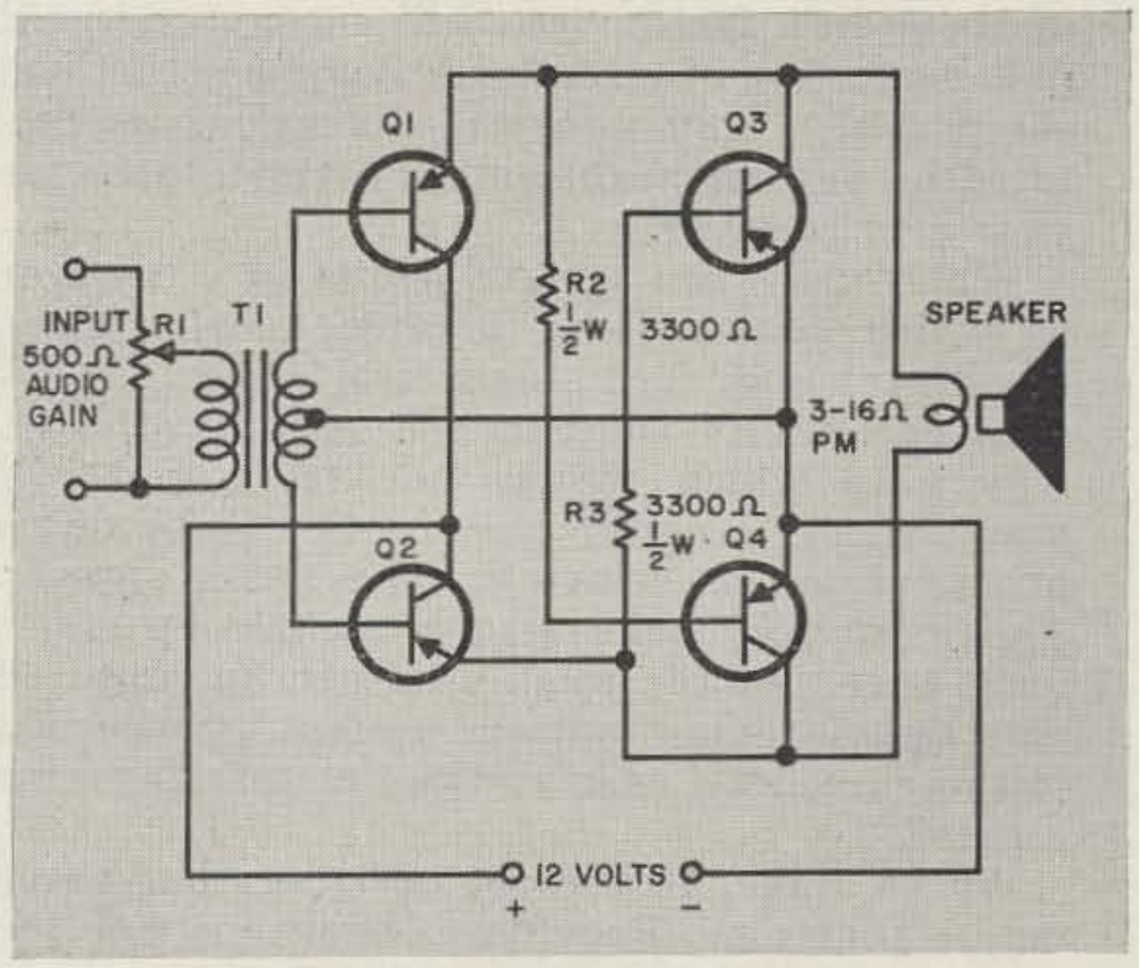


FIG. 2. Schematic diagram. Q1-Q2-Q3-Q4 should be PNP transistors of the same type . . . such as 2N107 or CK722. T1-Input or interstage transistor transformer. A Stancor TA-32 with primary and secondary reversed and only half of the original secondary connected was used in the prototype for deliberate mismatch to protect the transistors from overload.

a technical discussion of receiver front ends

Up Front

Staff

"You can't work 'em if you can't hear 'em," is one of the oldest maxims in ham radio. Since virtually no one is certain that his receiver possesses ultimate sensitivity, everyone wants to improve that department of his shack's equipment.

Fortunately, sensitivity of most receivers can be improved—and it doesn't cost a fortune, either. Tube designs developed during the past 10 years far exceed the wildest dreams of pre-1950 receiver designers, and as a result, improved receiver sensitivity is simple for older sets. Although newer rigs make use of the new tubes already, there are gimmicks for them too.

In modifying an existing receiver for greater sensitivity, you have a choice of three courses: substituting of hotter tubes, changing circuitry, or using plug-in adapters. The choice is up to you, but to make it intelligently you need full information about all results to be expected, both good and bad. That's the purpose of this article. In addition to a survey of the design factors you will encounter, you'll find a selection of circuits. At least one of them should, with only minor modifications as dictated by your requirements, prove suitable for your own receiver.

While there are several points in a receiver at which changes can provide greater gain, the "front end" (rf stages and mixer considered as a unit) controls the set's sensitivity. Any gain which follows the front end will amplify only receiver noise, and will be of no practical use in hearing those weak signals. The gain will make strong signals stronger, to be sure, but the weak ones can be captured only by improving matters up front. Since this is the case, let's look at the first rf stage for a start.

An rf stage, to the set designer, has three major functions. Providing sensitivity for the set is only one of the three. The other two are to isolate the local oscillator from the antenna and thus prevent radiation, and to eliminate or minimize image response. Frequently, commercial designs are based on isolation or selectivity rather than on sensitivity—and so can stand improvement in the matters of noise and gain.

Much has been written on the subject of noise in rf amplifiers, and many persons are now convinced that all rf amplifiers should use only triode tubes to achieve low-noise results. Don't you believe it. . . .

While triodes, with their fewer elements, do show lower noise than their pentode counterparts, the difference becomes significant only at VHF frequencies and above. Even at 50 mc, a well-designed pentode amplifier will reach below the level of antenna noise—and when you've gone that far, you're at the end of the line. No amount of improvement of your set can reduce antenna noise.

At this point, before reading much more, you can perform a simple test to determine whether your receiver is already at the limit of usable sensitivity. If it is, concentrate on the antenna—work on the receiver front end under these conditions is only wasted effort.

The test is this: Turn on the receiver and adjust all gain controls to the wide-open position. After the rig warms up, disconnect the antenna. Substitute a ½-watt carbon resistor with the same resistance as the antenna, at the receiver ANT terminals (use either 51 ohms, 75 ohms, or 330 ohms). Reduce rf gain until noise hiss from the speaker is barely audible. Disconnect the resistor and reconnect the antenna. If noise output increases, you're already able to receive antenna noise. If no increase results, your receiver can stand improvement. The test, incidentally, should be performed at your receiver's highest operating frequency since noise level from the antenna decreases with frequency.

If you're still with us, the next step is to decide whether you want to (a) use newer tubes (b) change the rf-stage circuits, or (c) use a plug-in gadget.

Use of a later-model tube which can be simply plugged into the set is always tempting—but this way lies disaster. Tubes vary in many factors besides that of gain; input and output capacity may be so far off that the set can't be aligned, the grid cutoff characteristic may prevent proper AVC action, the hotter tube may cross-modulate all signals. . . . The list is long and the pitfalls many. However, with proper care, excellent results are possible.

Circuit changes, similarly, can create many problems. Lead dress is critical above 25 mc. Circuits which are excellent at 30 mc give up and die at 3.5. The set may fail to track after modification. In other words, this too takes some prior planning.

Plug-in gadgets combine the advantages—and thus share the disadvantages—of both the other types of changes. In addition, they have peculiarities all their own. The worst is their tendency to oscillate, caused by necessarily long grounded leads. This can be cured by an external grounding strap—but it's an awkward device at best.

One aid to making your choice is to list everything you hope to achieve. If sensitivity (greater gain and/or less set noise) is the only goal, a simple tube switch with minor circuit changes will usually achieve it. On the other hand, if you need greatly improved sensitivity, better image rejection, and increased oscillator isolation your only hope is to change the complete circuit. In-between results may be obtained in any of the three possible ways.

Naturally, if you're switching from pentodes to triodes or vice versa you'll have to make circuit changes. Therefore, one of the early decisions leading to the big choice is that of which tube type to use.

To start with, all discussion of triodes vs. pentodes is based on the idea that only the best of each type are being compared. It's only logical that a fair triode will outperform a poor pentode, and than an excellent pentode will run rings around either.

But when you compare the best of each breed, you'll find that triodes are characterized by extremely low noise, moderate gain, and severe instability when used in conventional circuitry. Pentodes, on the other hand, have excellent gain and good stability, but show higher noise than their three-element cousins. For operation at 50 mc and below, the nod goes to pentodes when considering only the best of each type.

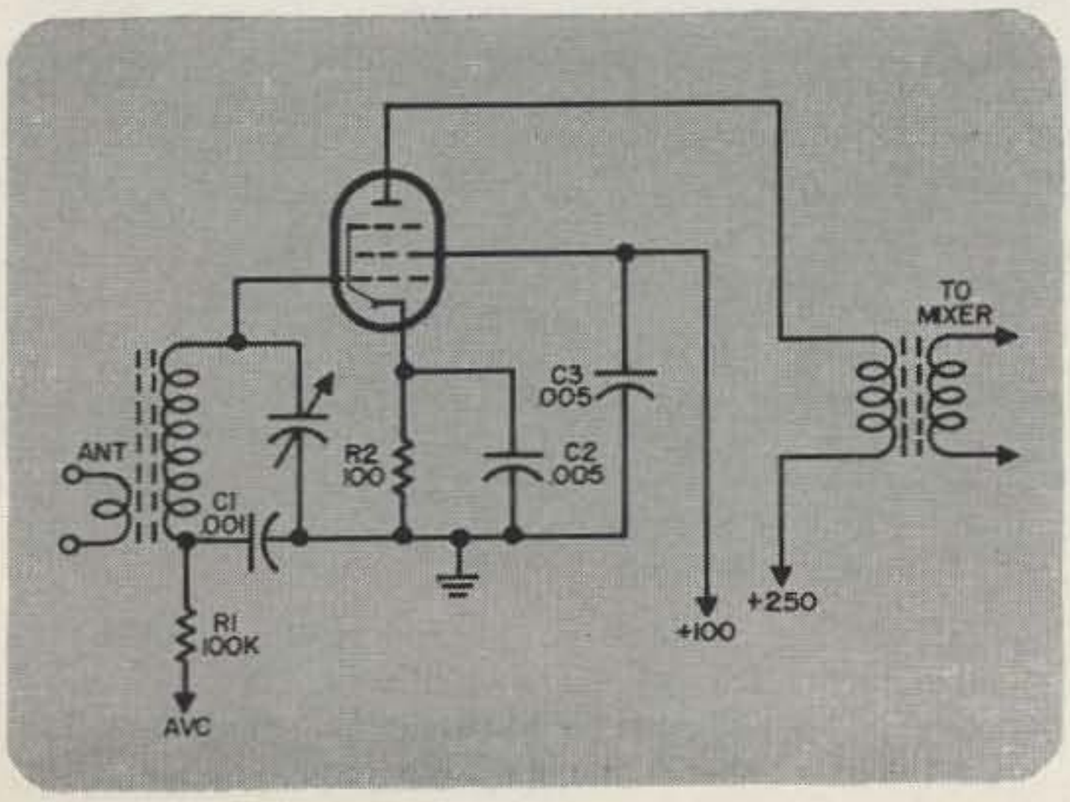


Fig. 1. Typical circuit of receiver first-rf stage. Tube may be almost any remote-cutoff pentode. Screen returns to low-voltage line established from receiver power supply.

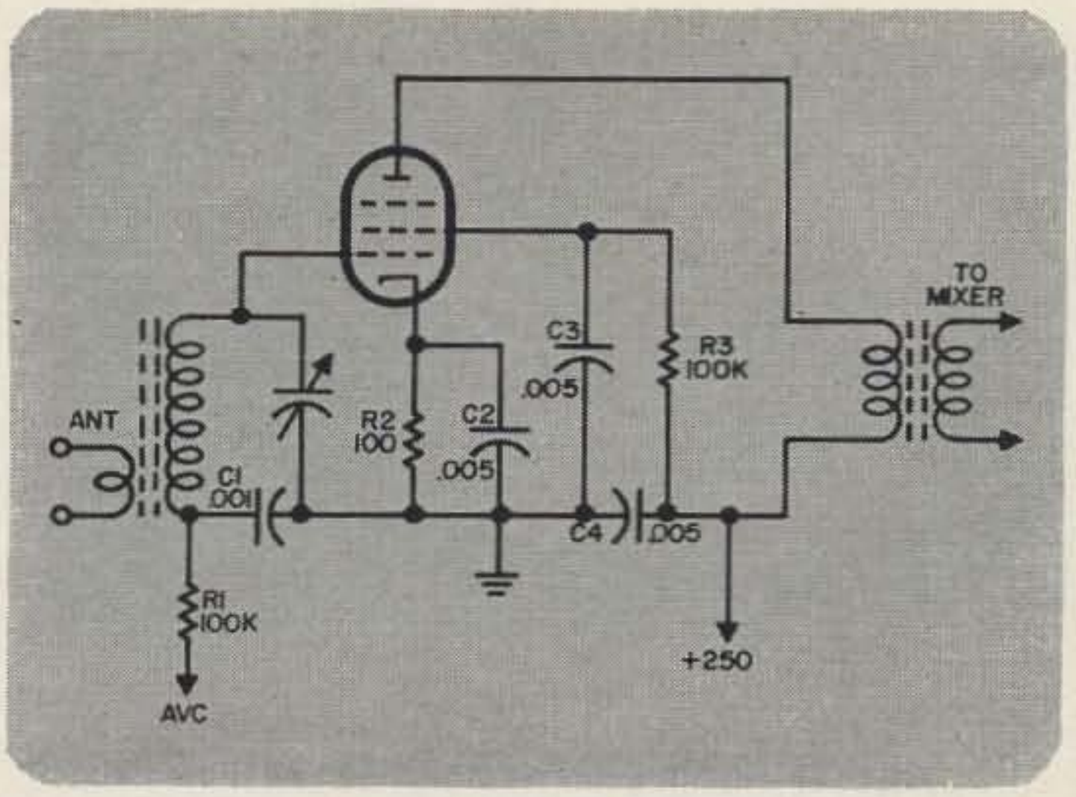


Fig. 2. Adding a high-valued resistor from screen to plate supply in the circuit of Fig. 1 results in the tube's gaining semi-remote-cutoff characteristics. No other changes are necessary.

In practice, quality is usually expensive. As a result, triodes hold a slight edge in the 20-50 mc frequency range, since the popular cascode circuit gives them both the pentode's advantages and retains their low-noise characteristic—all at a moderate price.

In addition, any rf stage can be converted to a cascode by means of a plug-in adapter (see the references) at low cost.

For use below 20 mc almost any recent-model pentode gives good results. Even the ancient 6SK7 series performs well at these frequencies, but it can be improved. In this range, tube substitution is the best policy.

To substitute tubes, start by obtaining a good tube handbook. The best are the RCA Tube Handbook HB-3, in five volumes and priced at $17.50, and the GE Electronic Tube Manual, also in five volumes and similarly priced. These books list all characteristics of all tubes produced by these firms, rather than the abbreviated listing of popular tubes found in the smaller manuals, and are highly recommended. However, information in the $1-range tube manuals is accurate and can be used.

With handbook in hand, first look up characteristics of the tube now used in your receiver. Write them down. Be sure to check input and output capacities, operating bias range, electrode voltages, and transconductance.

Then, start through the handbook looking for tubes which match yours in all characteristics except transconductance, which must be greater. The best areas to search first are the 6BA- through 6ES- type prefixes, since those are the newest types.

When you have several candidates, check to see that basing arrangements are compatible. It's easy to change socket connections, but not so easy to change the socket itself.

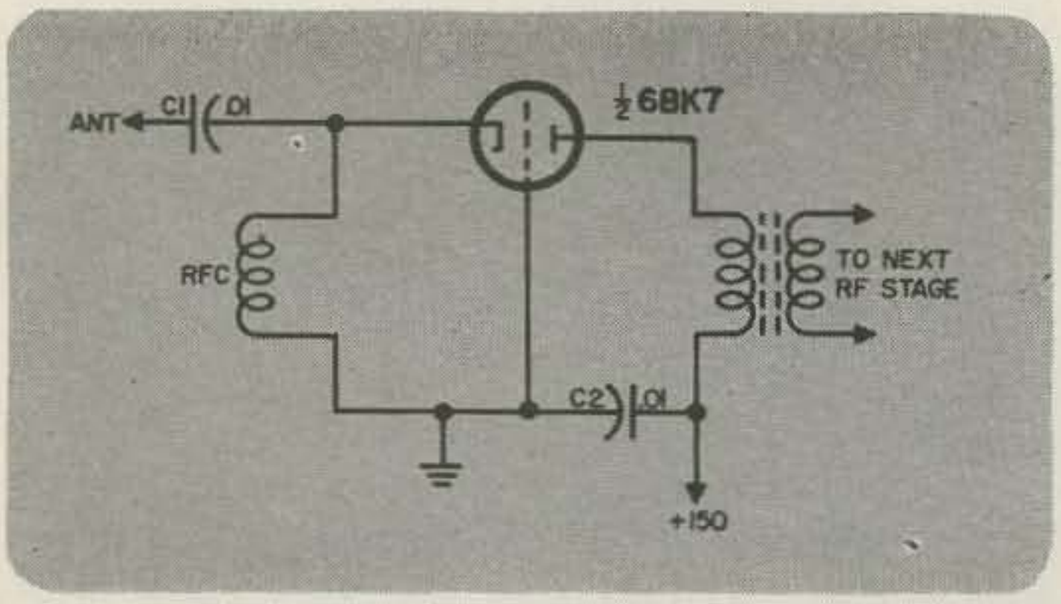


Fig. 3. The simplest triode amplifier circuit is the grounded-grid arrangement, shown here. Its major disadvantage is low gain, requiring at least two stages of rf amplification.

Finally, look at the characteristic curves for both the existing tube and your replacement candidates. If the general shape is the same, the candidates will probably perform satisfactorily.

When all this preliminary paperwork is complete, the only thing left to do is to try the tubes and see what happens. Plug in the replacement tube (making wiring changes if necessary) and try it. Check carefully for proper AVC action as well as improved sensitivity, and test for cross-modulation by tuning to weak signals near strong ones. If the strong signal rides in on the weak one, you have cross-modulation which must be corrected by changing to another type of tube.

One of the biggest compromises you must make when choosing front-end tubes is that between maximum gain and minimum cross-modulation. Remote-cutoff tubes are usually better when avoiding cross-modulation, but maximum gain is achieved only with sharp-cutoff tubes. Fortunately, it's usually possible to reach the antenna-noise level with good remote-cutoff tubes.

Tube substitutions usually take care of any problems below 20 mc. At higher frequencies the choice is between the use of plug-in adapters and changing the circuitry. Since plug-in adapters share many of the features of circuit changes, let's examine circuitry first.

The basic circuit used for the first rf amplifier in most receivers is shown in Fig. 1. Component values shown are only typical—exact values, naturally, will vary from set to set depending on the tube and the designer's whim. All bandswitching circuitry has been omitted for simplicity.

This circuit has no inherent noise properties, but the tubes most adaptable to use in it are not the most sensitive rf amplifiers available. As mentioned earlier, sensitivity and freedom from cross-modulation seldom go hand in hand. And in the circuit of Fig. 1, freedom from cross-modulation requires remote-cutoff tubes.

The simple change shown in Fig. 2 will make any sharp-cutoff tube act like a semi-remote-cutoff design, for reasons too complicated to go into in detail here. Component values in this diagram, also, are typical—with the exception of the screen resistor, R3, which is applicable to any tube.

With this change, you can safely use such tubes as the 6BC5, 6BC6, and 6DK6, all of which give higher gain than most remote-cutoff tubes.

If you decide to switch to triodes for their lower-noise properties, you can take your pick of a number of circuits. As mentioned before, there is little advantage in triodes below about 60 mc, but in a few cases they work better than pentodes.

One of the simplest triode circuits is the grounded-grid amplifier, shown in Fig. 3. Use of this circuit requires that two stages be employed, and overall gain will undoubtedly be lower than with the older pentode. Noise, however, will drop more than signal strength, which means that a hotter tube can be used in the *if* strip to bring back all the lost gain with lower front-end noise.

The two stages required by most triode circuits can be combined in the same space occupied by a single pentode. One way of doing this is by using the cathode-coupled amplifier, Fig. 4. Signal strength, again, will show a slight drop compared to the replaced pentode —but noise will be much lower.

The only triode amplifier circuit capable of competing at equal status with pentodes in the "stage gain" department is the cascode, shown in Fig. 5. Gain is equal to or greater than that of most pentode stages, while noise level is even lower than that produced by most other triode circuits. Since complete analyses of the circuit have recently been published

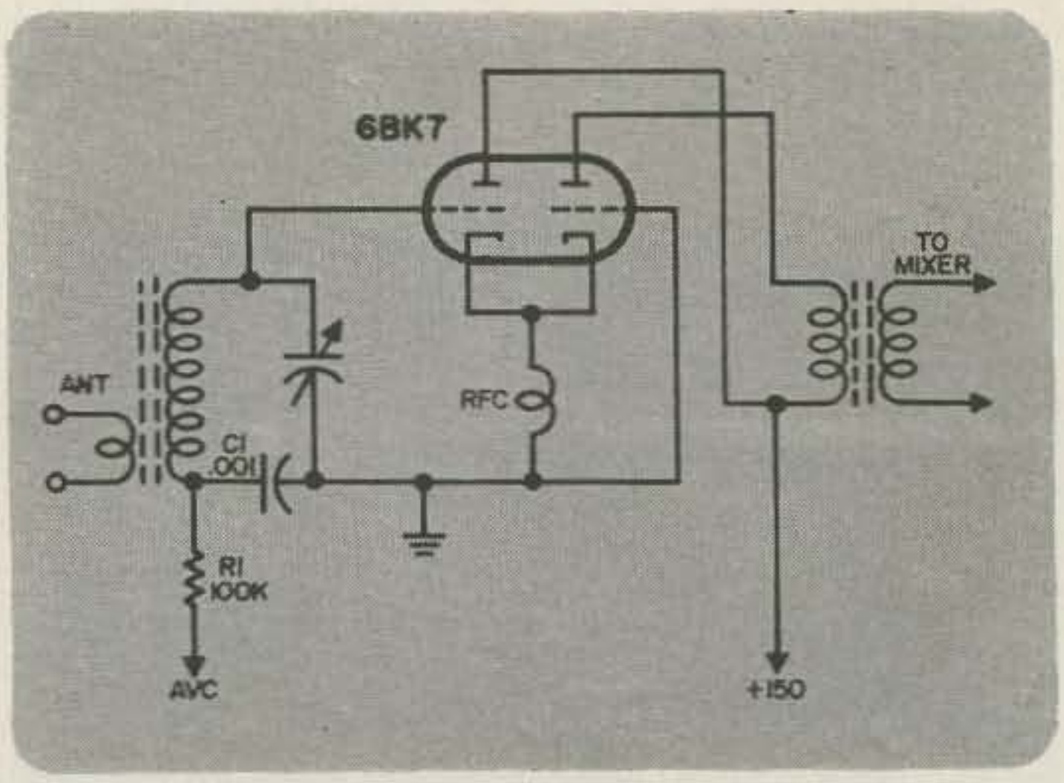


Fig. 4. This cathode-coupled amplifier can be substituted for standard pentodes in any receiver. The only part added to the receiver will be the rf choke in the cathode lead.

elsewhere (see bibliography), it won't be gone into in detail here.

Any of these circuits can be constructed on

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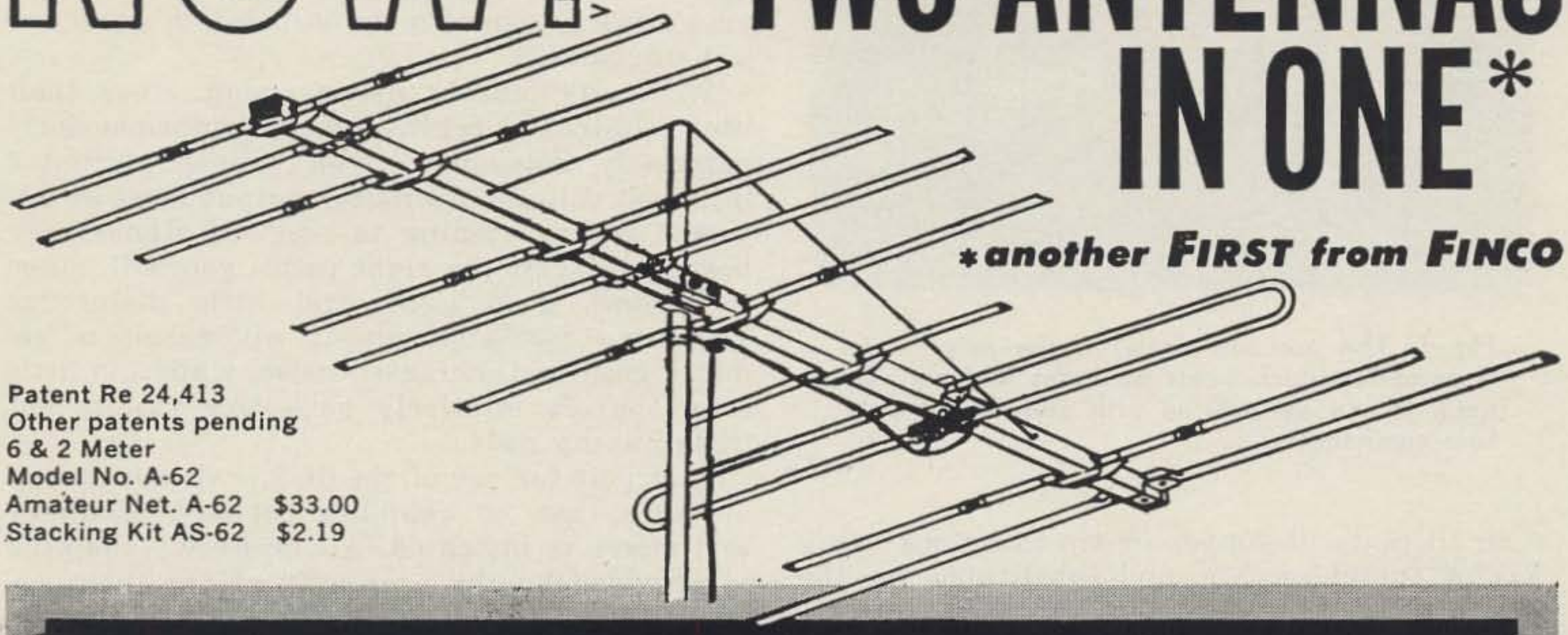

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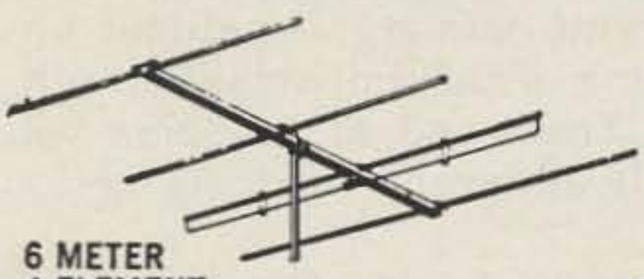

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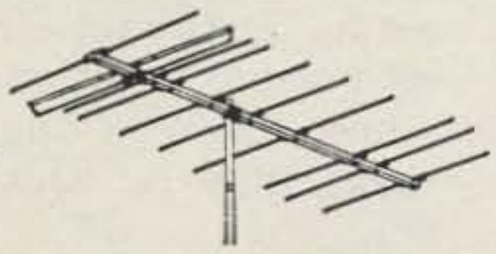

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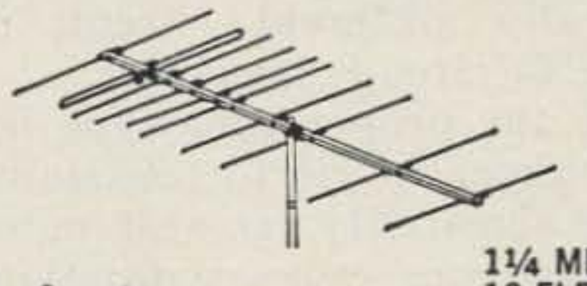

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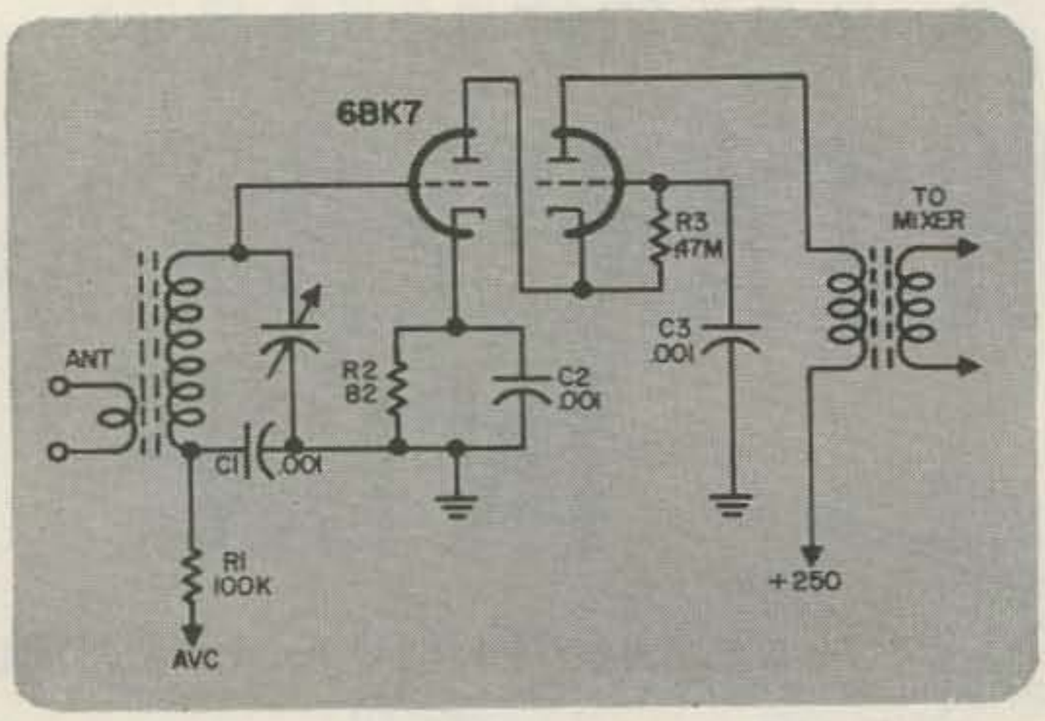

Fig. 5. This cascode circuit is the only triode rf amplifier which beats pentodes in their own field. It can be built in with addition of only four components.

a small plate of copper or tin-can stock using Vector turret sockets, and substituted for the old octal socket in the set. Naturally, the receiver must be realigned after any such change.

These circuits (except the grounded-grid) are also adaptable to being constructed in the form of plug-in units which simply substitute for the existing rf tube. Complete units of this nature are the S-9er, the Improved S-9er, and the S-9er Mark II (see bibliography again). The pentode circuit change can also be incorporated into a plug-in adapter.

With noise in the first rf stage minimized, it's time to check elsewhere in your efforts to attain the ultimate in sensitivity. Frequently, the mixer stage of a receiver makes a substantial noise contribution and masks weak signals. This is especially true if the first rf stage is not doing its job properly, but by now that portion of your set should be at peak performance.

The difference between a quiet and a noisy mixer is largely a matter of tube choice. Mixer tubes designed especially for low-noise service include the 6BA7 and the 6SB7-Y (now almost obsolete.) The 6U8 is a good one also but usually requires circuit changes.

If you don't mind extensive surgery inside the set, substitution of a 6AC7 operated as a pentode mixer as shown in Fig. 6 will yield exceptionally low-noise mixing action. However, you may experience a bit of difficulty in realigning the set after this change due to the drastically different circuit and resulting change in circuit capacities.

Once the proper tube type is substituted, a few changes in circuit constant may increase mixing sensitivity. Lowest noise and greatest freedom from cross-modulation are obtained with a non-grid-leak-biased mixer. However, such mixers are also the most sensitive to variations in oscillator output and so are usually avoided by set designers.

Bias values for the mixer tube of your choice can be obtained from the tube-handbook charts. Either fixed grid bias obtained from the power supply or from a mercury cell, or cathode bias developed across a resistor of the proper size (as shown in Figures 6 and 7), can be used instead of the original grid-leak biasing. The grid resistor can then be reduced in value, or left unchanged.

With any biasing arrangement other than the grid-leak circuit, mixer performance is extremely dependent upon proper oscillator injection voltage. Oscillator output must be adjusted while listening to received signals, for best results. At the right point, you will notice low noise, good gain, and little distortion. Excessive oscillator output will result in reduced gain and increased noise, while too little output gives relatively noise-free results but little mixing gain.

A circuit for use of the 6U8 is shown in Fig. 7. Note that no coupling between oscillator and mixer is indicated. All necessary coupling is provided by the proximity of the tube sections within the envelope. This circuit, adapted from the *International Crystal Mfg. Co.* model

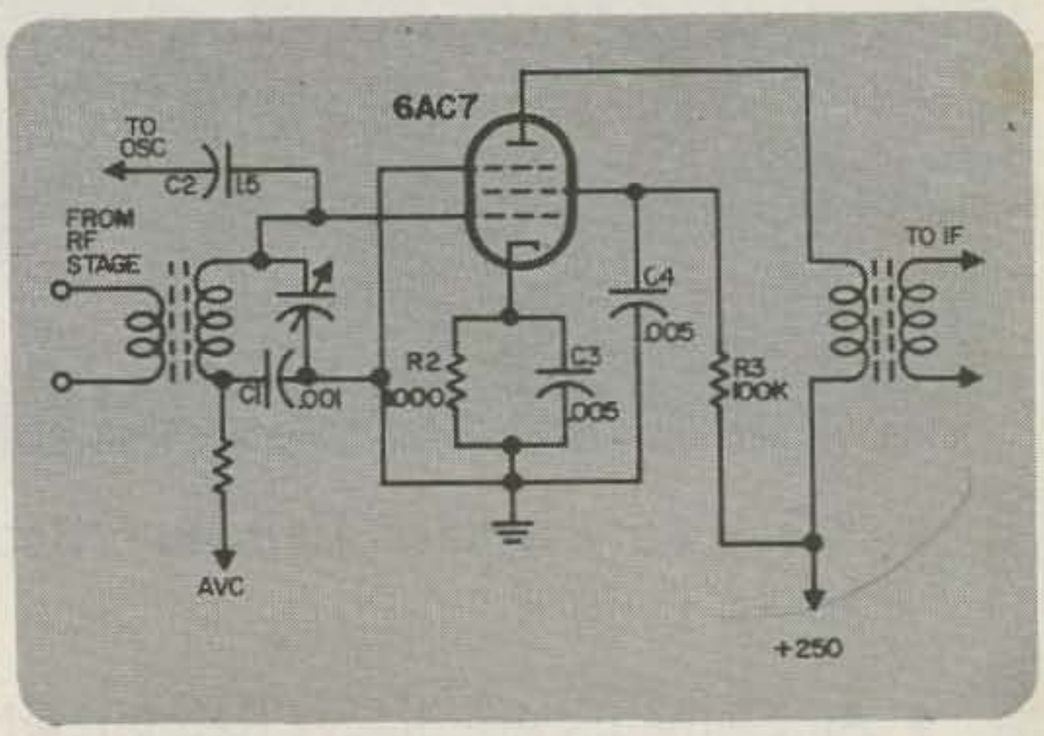

Fig. 6. The 6AC7 mixer circuit shown here gives lowest mixer-stage noise output of any frequency converters tested, according to research reports. Its major disadvantage is the extensive set surgery required for installation.

FCV-2 converter, provides exceptional results when preceded by one stage of rf amplification, even at 144 mc.

With both the rf stage and the mixer cleaned up, there's little more to do in your search for sensitivity. It's a good idea, however, to check AVC action after all modifications have been made. Tube and circuit changes sometimes upset normal functioning of this important circuit, since action of the front end at low bias voltages may be vastly different from its action near tube cutoff.

To check AVC, tune across the broadcast band if your receiver has one. Lacking that, listen to the kilowatt down the block. Examine the signal carefully to see if you can detect distortion, splatter, or other objectionable features (the broadcast station is recommended

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for this test, since the characteristics of its signals are more closely controlled.) If you spot trouble, repeat the test on a weak signal.

If trouble is apparent only on strong signals, the AVC circuit probably is at fault. Most usual cause of this difficulty is indiscriminate tube substitution without regard for cutoff characteristics; a tube which goes dead at 10 volts bias can't give good results when used on an AVC line developing 20 volts.

Double-check the cutoff curves and values for both the old and the new tubes. If there's much difference, rig voltage dividers using the AVC resistors (R1, Fig. 1) as the upper leg of the divider to cut AVC voltage down to size. This usually cures the problem.

After finishing this test and any necessary rework, go back and repeat the sensitivity test. You should, now, have no difficulty in reaching the antenna-noise level. Tune across 10, 15, or 20, and note the difference. Your receiver now has what it takes, where it counts —up front!

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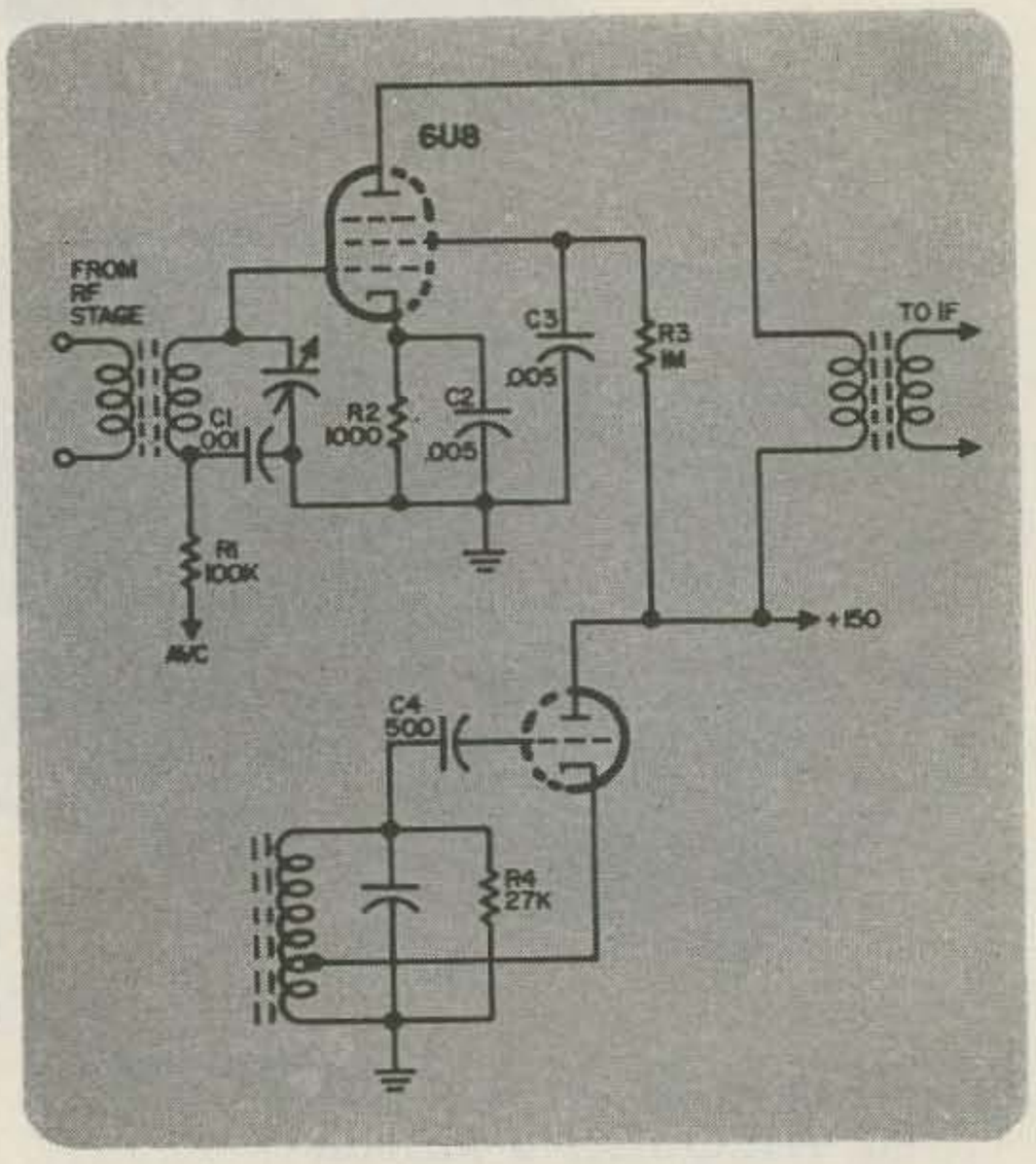
Fig. 7. Using half of a 6U8 tube for the oscillator and the other half as a mixer, this circuit is capable of outstanding performance at frequencies up to 148 mc. It requires only one stage of rf amplification ahead of it.



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Hadlock, **Design Considerations of 50-Mc. Converters.** QST, March, 1957.

Jones, W6AJF, **Low-Cross-Talk Six-Meter Converter,** QST, June, 1957.

Available from Radio Bookshop.

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"THE ONLY good bug is a dead bug," says one of the TV commercials. A little listening on the CW bands may convince us that this rule should be applied to ham radio too. Not so. Despite all of the horrible examples we hear on the air it is true that any operator can master these slippery customers. If you get the bug to use a bug get the bugs out of the bug before you bug people.

The first consideration, of course, is what kind of bug to buy. There are several fine models on the market which boils the situation down to your own personal preference in styling, size and weight. Weight is an important factor since there is nothing more annoying than to have the bug go jumping around on your operating table from the force of your fist. You can always screw it down to the desk top, but a properly weighted base will result in one less hole in your expensive ham shack furniture.

We'll gloss over the dubious financial strategems you may have to employ to promote yourself to bug ownership and skip ahead to the message. Now that one of these desirable little doohinkies graces your operating table are you ready to step up and master it?

You can answer this question only after answering a couple of others. First, can you handle a straight key satisfactorily at twenty words per minute? Second, can you make solid copy at least the same speed or better? If the answer is yes to these two latter questions, it will be yes to the first one. You are now ready to take the sacred oath and vow of all good bug twiddlers. Repeat after me.

"I, Sam Lieberknocker,* do take this oath and vow that I forever more will keep this little monster under control at all times and never exceed the speed limit set by my own capabilities. This, I swear to on a stack of TVI complaints."

Now that this impressive ceremony is over and we have dried the tears of emotion from

*In case your name does not happen to be Sam Lieberknocker it is permissable to make a reasonably accurate substitution as long as you do not make any other modifications, however slight, of this ritual.

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Once you have the oscillator working it is time to adjust your bug. First, check the adjustment of the pivot bearings on the dot armature. These should be loose enough to allow the arm to move freely in a horizontal direction between the two stops but there should be very little vertical play. Next, move the weights out to the end of the dot armature and tighten them securely. Loosen the right hand dot armature stop adjustment. Operate the armature with your left hand and set the stop so that when the paddle of the bug is released, the armature damper stops all armature vibration at the instant it comes to rest against the stop. Screw down the locknut and take a drag on your cigarette. Relax, you should never have to make this adjustment again. Now set the left hand armature stop so that the tip of the armature travels in approximately a half inch arc.

With the dot armature pushed over against the left hand stop, screw the adjustable dot contact up until it touches the spring contact. Check to see that they align perfectly, then back the adjustment off again. Operate the dot armature and adjust the contacts until you can hear approximately ten good clean dots before the armature quits bouncing. Lock the adjustment and relax again. Set the dash contact spacing and spring tensions to your liking and we're ready to give the little rascal a trial twiddling.

The proper way to handle the paddles is up to you. Of course, there's no way out of using your thumb on the dot side. For the dash side, pick a finger that's handy and comfortable and relax your arm. The secret of good clean sending on your bug is to keep your arm and wrist relaxed and use a smooth combination of wrist and finger motion, plus rhythm. A good exercise is to sit and practice sending a series of V's.

Fire up your receiver and tune around on the commercial frequencies until you find a station running around twenty to twenty-five words per minute with tape sending. If you happen to have the type of receiver that tunes only the ham bands, don't be discouraged, there are plenty of commercials using these frequencies too.

Now that you've found one, listen to the dots. Cock your other ear toward your oscillator and punch the dots on your bug. Adjust the weights on the dot armature until they are the same speed as the tape. If they seem too heavy or light after this maneuver, a slight adjustment of the spacing between the dot contacts will remedy this. Of course, if you are lucky enough to have your own tape machine, you can forget about the above system and check your bug against its sending. We all know that a dash is supposed to be three times as long as a dot. Remember this and get your latest copy of "73" off the shelf and practice sending text from it. Try to make your fist as identical as you can to tape sending and don't worry about picking up speed. One of the common faults of some bug twiddlers is that they send their dots at sixty wpm and their dashes at twenty. Speed will come with practice.

You've no doubt noticed that between us we haven't even mentioned trying your bug out on the air. I know you're anxious to give it a whirl but please think of the guy who would have to try and unscramble your first efforts. Listen around for awhile and you'll find the type of character who has learned to send CQ and his call very neatly on his bug. Then listen to what happens when he comes back to a call. He sends *6*'s for d's and b's, i-n for f, etc., etc. The point is that you certainly have more respect for your reputation and that of your station than to get on the air before you can handle yours. It may be boring but keep at it with the oscillator and practice, but the practice you get in this manner will make the difference between the smile of appreciation when another ham tunes your signal or having him laugh as he tunes away from "that Lid!"

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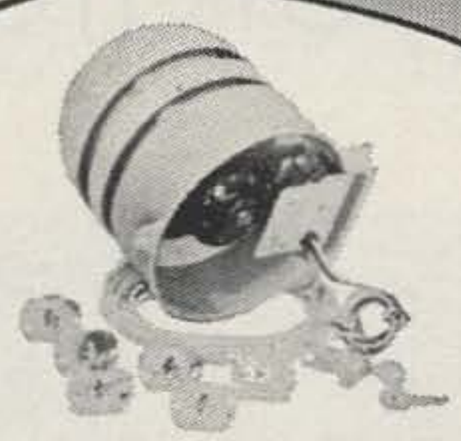

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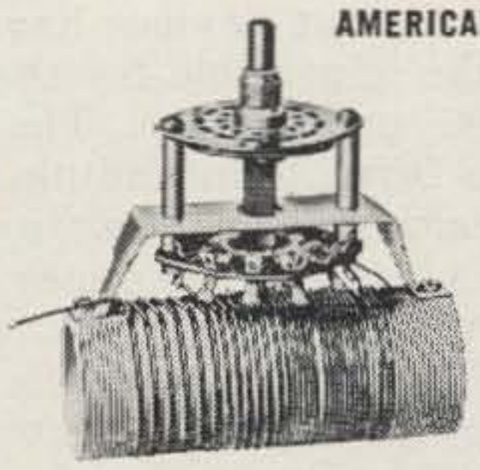

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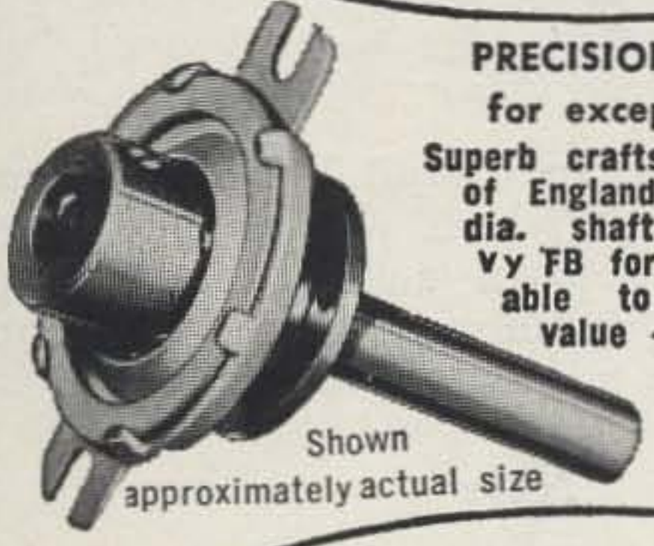

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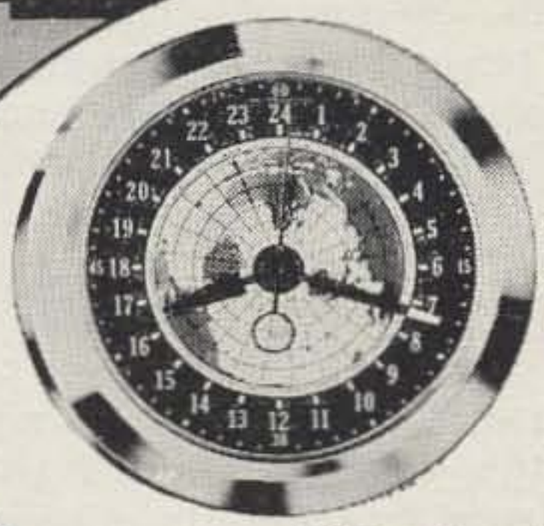

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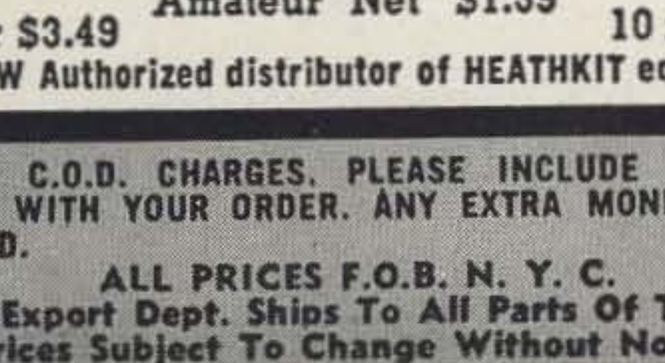

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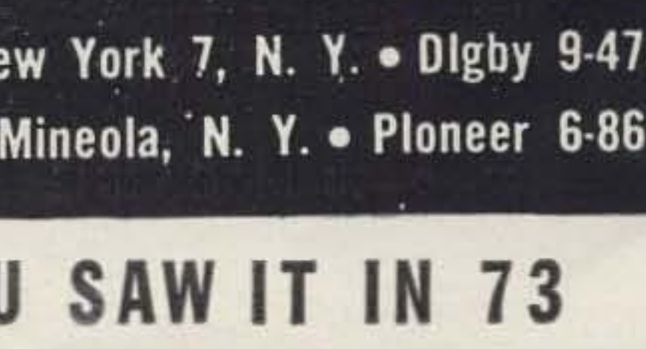

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SAY! YOU SAW IT IN 73

A Varicap Tuning Device For the Blind Operator

Robert E. Baird W7CSD
Box 2381 Oretech Branch
Klamath Falls, Oregon

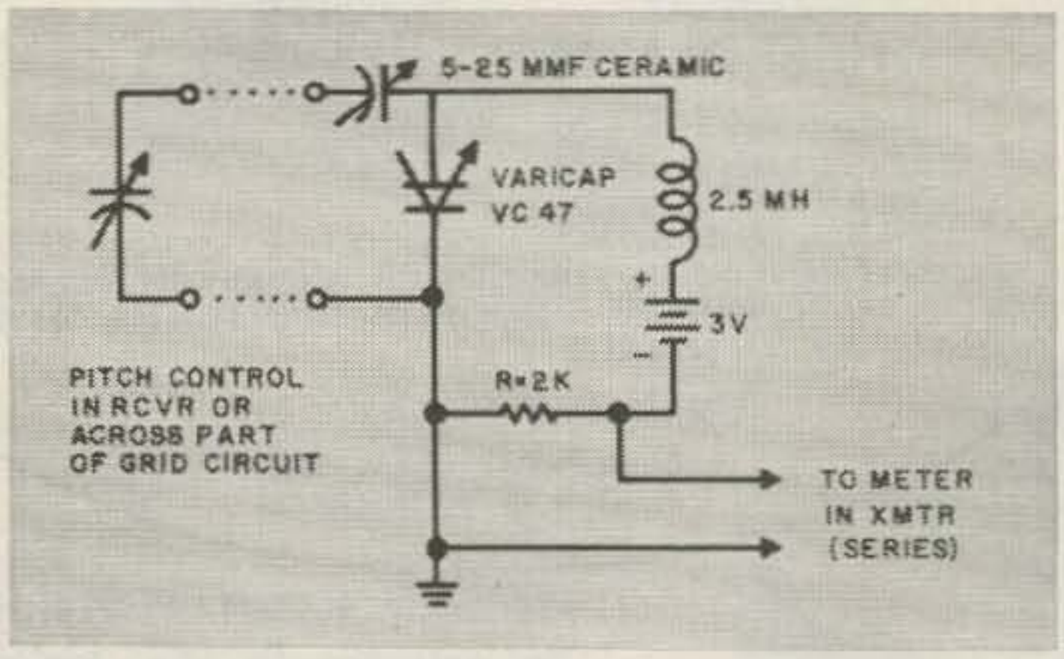
FROM time to time various devices have been rigged up to make it possible for the blind operator to tune his transmitter. The basic problem is always to furnish an audible signal that will indicate maximum or minimum current normally noted visually on a meter. Since the advent of modern transmitters that switch a single meter, in many models with the meter on the ground side, to several circuits the problem has become less complex.

The unit to be described in this article centers around the Varicap and a few other small components. We will assume the transmitter to be used has a basic meter movement of O — 1 ma, as this is very common. If such is not the case modify R to a value that will have about 2 volts IR drop across it for full scale meter reading. The following circuit will make operation of this device almost self evident.

With a maximum of 2 volts IR drop across R it can be seen the voltage applied to the Varicap will vary from 1 to 5 volts depending on the magnitude and polarity of the current to be measured. Since the voltage applied to the Varicap determines the capacity of the Varicap it will also tune the BFO of the receiver and hence change the pitch of the note if the receiver is tuned to any fixed carrier.

Operation

After the components have been installed in the receiver, tune to any fixed carrier. With the BFO turned on and pitch control tuned to midrange, adjust whatever parallel control there may be, (capacitor with screw driver adjust or variable slug) until the beat note zeros. The receiver is now back to normal. Now tune the pitch control 150 or 200 cycles on the high side. Plug the metering cord into the connection in transmitter which will put R in series with basic meter movement. Energize low power stages and turn switch to amplifier grid. If any grid current is being drawn at all the pitch of the BFO will increase. The higher



the current the higher the pitch will be. Tune for maximum pitch which will be maximum grid current. Now turn switch to amplifier plate and tune for minimum pitch. Minimum pitch will indicate minimum plate current.

Note

In case it is not known which is the low or high frequency side or in case you wired the Varicap and battery using reversed polarity it may be desirable to get visual aid the first time. Which ever side will give an increase in pitch with an increase in current and a decrease in pitch with a decrease in current is the proper side to use. With a little practice a blind person will be able to tune as close by ear as others can by eye. Sensitivity is a function of how far off zero you tune the BFO and also the size of the variable ceramic capacitor in series with the Varicap. A little adjustment of both may be necessary.

The illustration shows the components in place directly on the grid of the BFO on an old HRO. Wiring would be equally simple on any communications receiver.

Caution

Don't try to use this circuit if your transmitter is metered in the high voltage side of the circuit.

Noise Clipper

Semi-Conductor Style

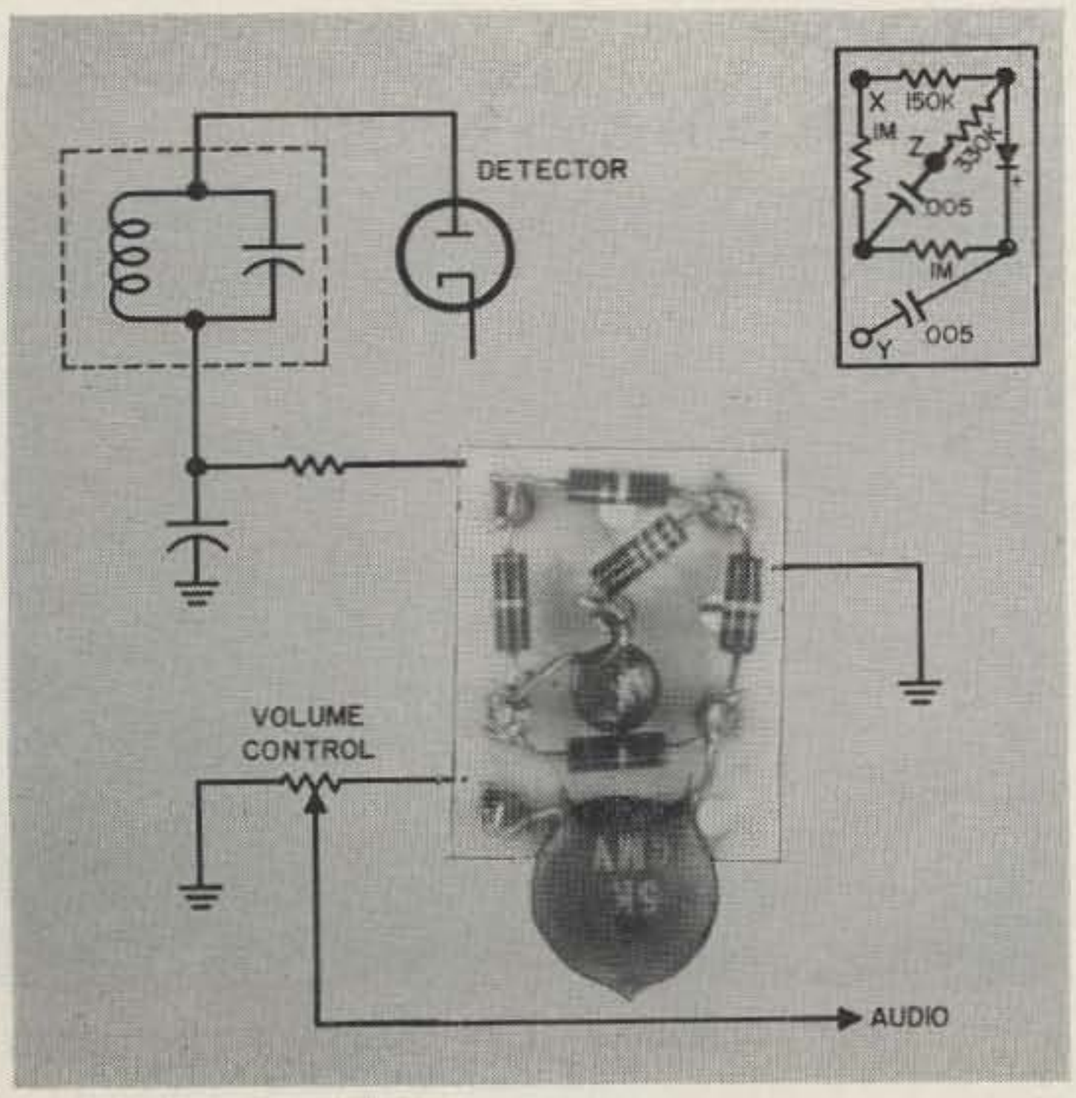
Al Newland W2IHW

WITH the current trend towards miniaturization and the attractive price of silicon diodes, we now can construct a small inexpensive semi-conductor noise clipper. As shown in Fig. 1, the pre-fabricated clipper is small enough to conveniently fit into a printed circuit type radio. If you do not care for the pre-fabricated version, you may wire the components in directly, as they are all small and self supporting.

In selecting the diode, we are interested in its back resistance and a value of at least 100 megohms is desired. The back resistance may be calculated by dividing the PIV by the back current. The two latter values can be obtained from the published characteristics of the diode. We mention the foregoing to prevent the builder from spending unnecessary time looking for the exact diode that we used.

It is suggested that the value of the capacitor C1 be found experimentally after the unit is in operation. A value between .001 and .005 is suggested. In the schematic, we show a .005. In the photo of the actual unit, a .001 is shown. Increasing the value will increase the clipping action. Excessive clipping will clip too much audio. If you desire to make provisions for switching the clipper in and out, a single pole single throw switch connected across the diode is satisfactory.

Note: The unit shown in photo is 1"x¾". 73



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——Translation
——Xsistor GDO
——Ign Interfer
——Superregen
——Debugging
——Top Loading
——CW Xmission
——All Band Ant
——Double PS V.
——Patch Patch
——432 mc Xsistor
——2M Xmtr
——Squawk Box
——Up Front
——Don't Bug
——Varicap
——Noise Lim
——80M DXing
——DC Meter Amp
——Motorola Test
——Propagation
——Sine YB
——Save-Learn
——File QSO's

Sam Harris W1FZJ, Chief Op at W1BU

80 Meter Phone DX

Fred Collins W1FRR
Microwave Associates, Inc.
Burlington, Mass.

"CQDX80." This is a familiar call heard on the low end of the 75 meter phone band during the winter season. Usually one thinks of DX on 75 meters to mean a contact two states away, but we mean a contact in excess of 3000 miles such as Europe or Asia or some far exotic country. In other words DX on 75 meters means the same as it does on 20 or 15. Working DX on 75 takes a special type of operation, if you want to work DXCC as fast as possible then you had better stick to 10, 15 or 20; but if you are interested in doing it the hard way, 75 is your band. If you are interested in working DX reliably, it is very desirable to have some sort of vertical antenna and medium to high power. Although when conditions are good almost any antenna configuration will produce excellent results.

A great deal of experimenting has gone into 75 meter DX antennas both for transmitting and receiving. To date the most satisfactory all-round antenna has been a sloping vertical antenna. In order to construct this antenna you must have one high mast preferably in the 100 foot region, and string a dipole towards the ground at a 30° to 40° angle. If necessary, because of limitations in height, the dipole may have loading coils at the ends. This type of antenna will be directive towards the low end with a front-to-back ratio of 15 to 25 db depending upon the angle of the received signal. It has been found that a true vertical has too low an angle for most 75 meter DX work. The standard 75 meter (quarter wave) high flat dipole under most conditions will do quite well.

Most of the European stations operate from 3780 to 3800 although if requested they will go down into the CW band about 3600 kc. The South African stations operate between 3690 and 3700. The New Zealand, Australia, Central and South American boys are apt to appear anywhere from 3600 kc all the way up to and including our phone band. For the most part the United States stations transmit between 3800 and 3830 kc on lower sideband. Most of this work is done on single sideband using lower sideband, but is not necessary limited to SSB as many of the DX stations worked are operating AM and have a good deal of success. A receiver with selectable sidebands, good selectivity and sensitivity is almost a necessity due to the very high interference on the DX stations frequency.

The received signals usually range from S1 to S8, therefore some sort of notch filter or Q multiplier is quite helpful in eliminating dead carriers and CW stations that appear in the form of interference. As far as eliminating AM or SSB interference there is not much

Garland Tomlin K1IDR and his medium power DX final amplifier

that can be done about it if it's in the passband except sharpen up the receiver and try to ignore it.

The European stations have been coming through in the late afternoon around 2100 GMT through 0800 GMT. When the Europeans start coming through it is still daylight here and of course it's well into the evening there. Because of this light and dark zone a type of one way skip is quite apparent. About one hour after sunset they are able to start hearing us. This one-way skip is caused by the number of times our signals must get reflected in the high absorption light area versus the long relatively low absorption dark area they are in.

The results obtained in the past few years' DX tests have been very gratifying indeed. W1BU worked WAC in the course of one evening thanks to 4X4DK appearing on 80 meters SSB. Early evening skeds have been held with GW3EHN, F7HC, GW5TJ and several other Europeans with good success. W1BU and W1FOS have been holding late schedules with G2HX, PAØFM, GW3EHN, G6VX, DI4PI, YV5ANS, ON4ZA, 4X4DK, UA1D2 and many other this last winter with only one or two exceptions. ZC4AK has been coming through from Cyprus with fair signals. ZL1ACG and ZL2AIX with good signals have been heard and worked consistently anytime after 0500 Z. ZS6AMV, ZS6AJH and ZS6KD have come through with fair signals.

If your interest has been aroused and you don't mind working for your DX drop in on the low end of 75 and try your hand at it. We sure could use more DX stations on 80 phone. CU on 75. . . . W1FRR

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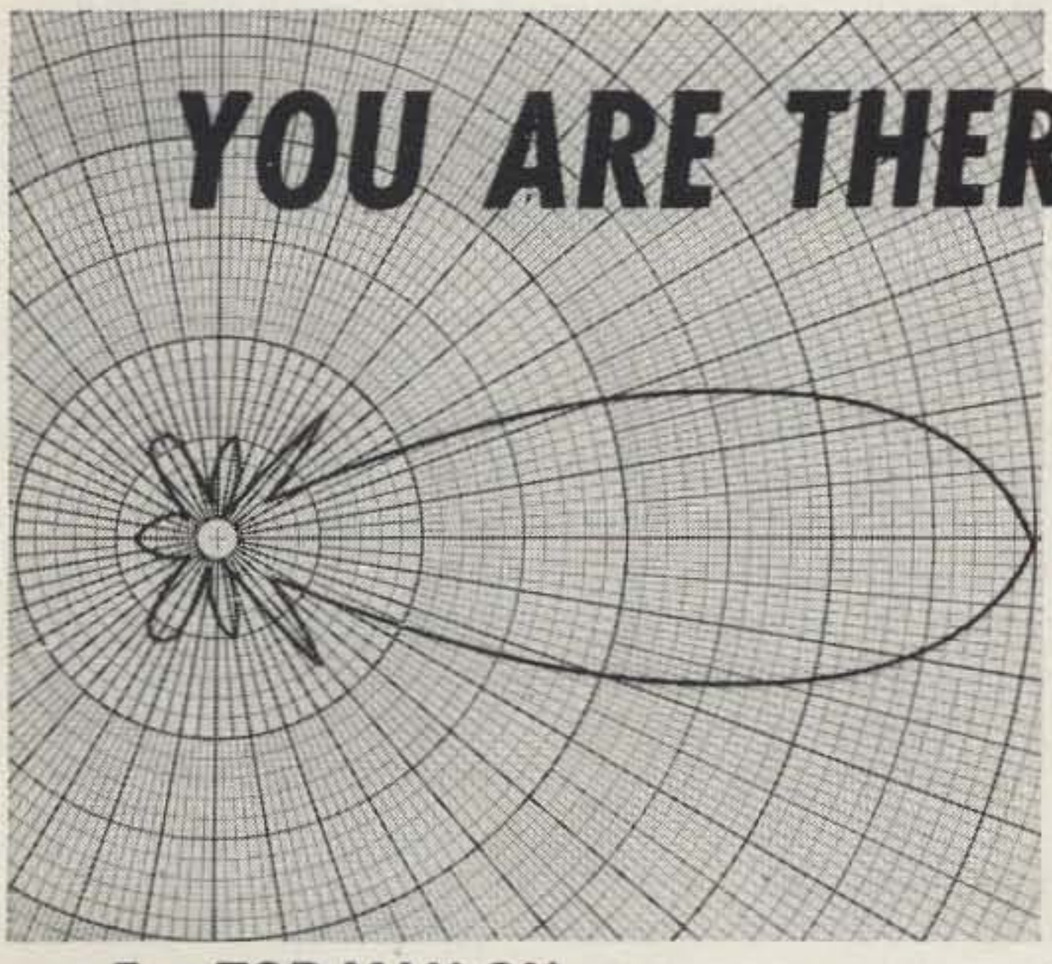

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A Transistorized DC Meter Amplifier

Roy A. McCarthy, K6EAW
737 W. Maxzim Ave.
Fullerton, Calif.

PRACTICALLY everyone has an inexpensive 0-1 ma meter around the shack or in the junk box. By using this simple amplifier circuit the sensitivity can be increased to 10 microamps full scale, and the zero can be adjusted to the center or right end as well as the usual left end. By adding a few selected multiplier resistors and a range switch a voltmeter with 100,000 ohms/volt can be quickly assembled. Or, if used with the capacity meter in the October '60 issue, as low as 10 mmfd full scale can be measured. Field Strength meters also benefit by the addition of a linear current amplifier with a gain of 100.

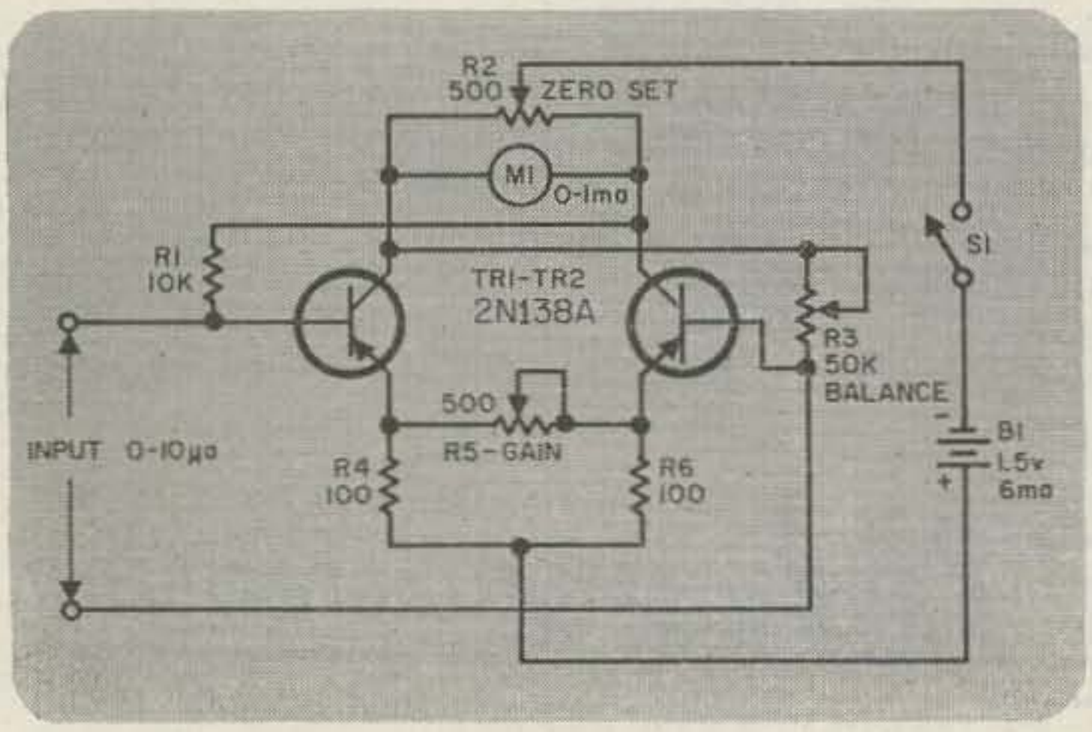
The circuit is the familiar balanced amplifier, with the addition of both positive and negative feedback. The positive feedback obtained with R1 and R3 in Fig. 1 increases the gain of the circuit by a slight amount to compensate for transistors which have a bit less gain than desired. Negative feedback is provided by R4 and R6 and is controlled with R5 to set the gain to exactly 100. The two transistors are first selected as closely matched as is convenient for Beta and IcO. Further balancing is done with R3 and R2. R2 is also used to set the zero position of the pointer. The battery, B1, can be a regular or penlight flashlight cell, since the circuit is relatively insensitive to wide changes in the voltage. Zero drift with a temperature change from 75° F to 115° F was less than ten percent.

The transistors used were a pair of 2N138's with Beta of 130 and IcO of 6 uA. Other suitable types would be the Raytheon 2N467 or the General Electric 2N508.

An inexpensive trimpot was used for R5 since it is a "set and forget" control. A screwdriver adjust pot was used for R3 since it is also a set-up control. The zero set, R2, and the switch S1 are all that are required to be used in normal operation, and could be combined if desired. TR1 and TR2 should be mounted close together and away from any sources of heat if the amplifier is mounted in any existing vacuum tube gear. The meter used had a resistance of almost exactly 100 ohms. Use of meters with a different resistance may require adding a slight amount of fixed resistance in series in order to avoid changing the other circuit constants. Obviously the iron-vane type meters which require several volts for operation cannot be used.

Nothing is ever obtained free and the hidden price here is the increase in impedance. The circuit turned out to have an input impedance of 8400 ohms, as compared to the original 100 ohms of the basic meter movement. For a current gain of 100, we have the impedance increase of almost 100. Actual measured voltage sensitivity was 84 mv at 10 μa full scale, which is still much better than a popular 100,000 ohm/volt multimeter.

The initial set-up consists of setting R3 to approximately 10K, adjusting R2 to give an on-scale reading, then shorting the input and noting the reading. Remove the short, set R3 to the noted reading, then set R2 to zero the meter and apply a known current or voltage. A separate flashlight cell and a 300K ohm resistor will supply 5 ua. R5 is then adjusted to give the desired gain for 10 μa or $\pm$ 5 μa. The controls have some interaction so all adjustments should be repeated several times until the circuit is balanced and calibrated. The input impedance should be allowed for in calculating low voltage multipliers. 73



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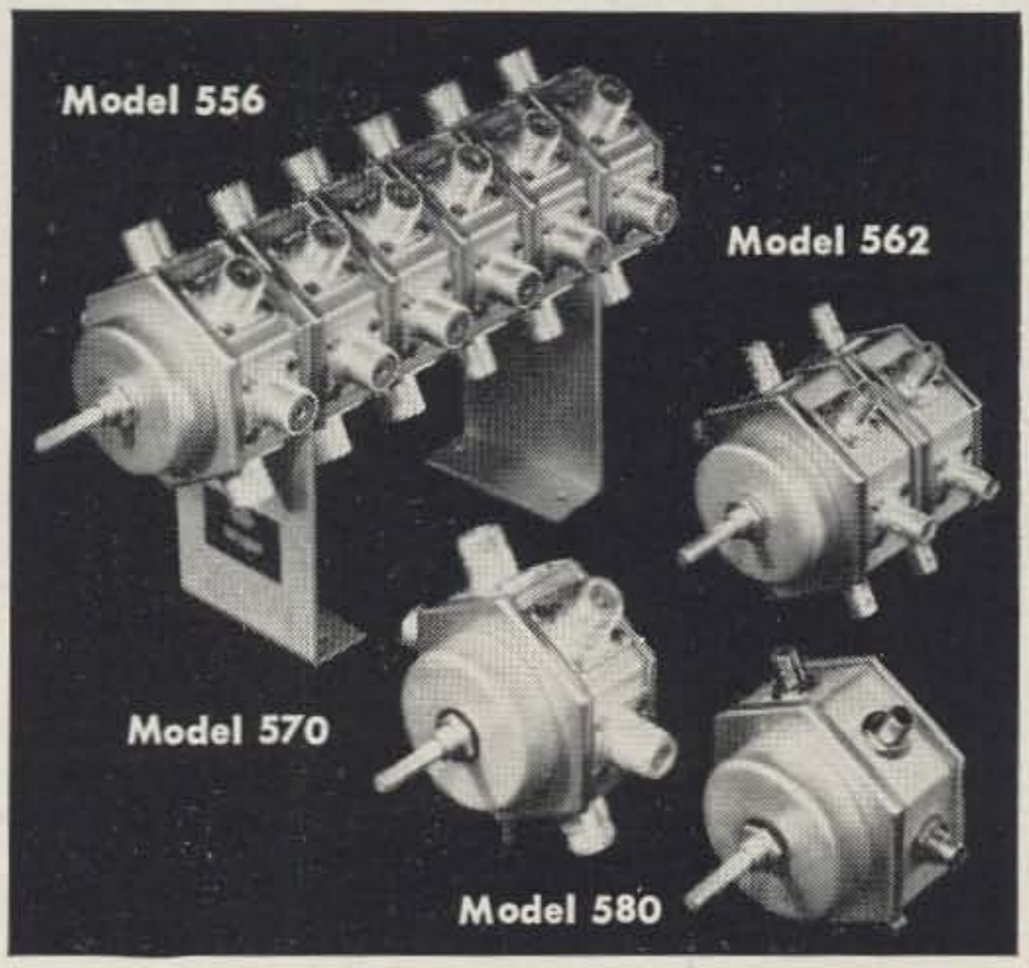

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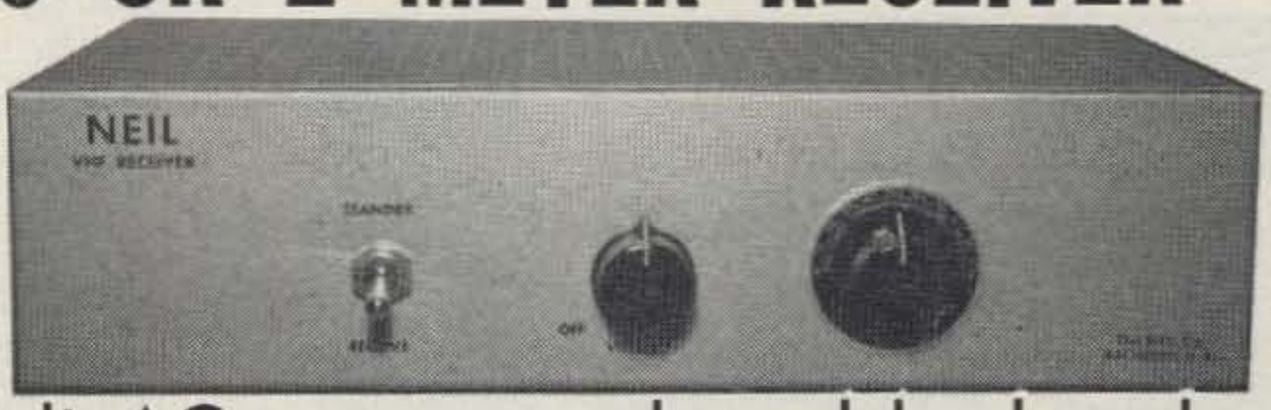

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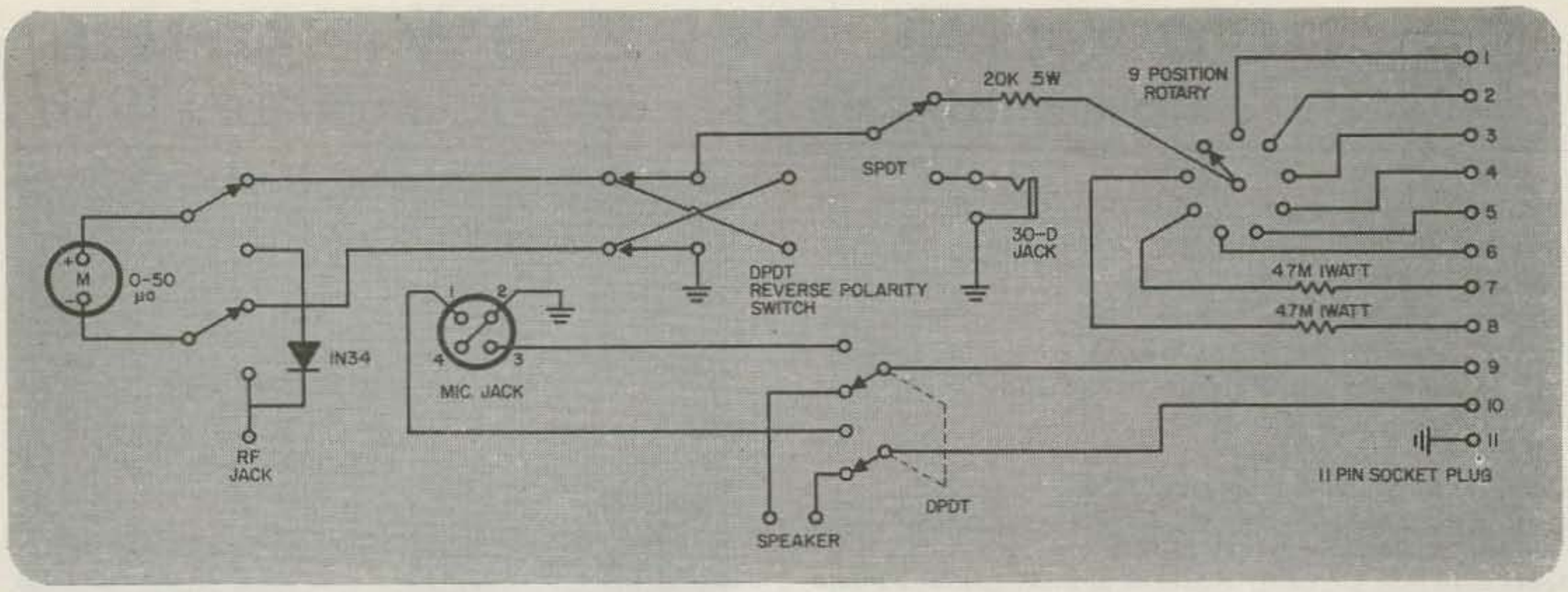
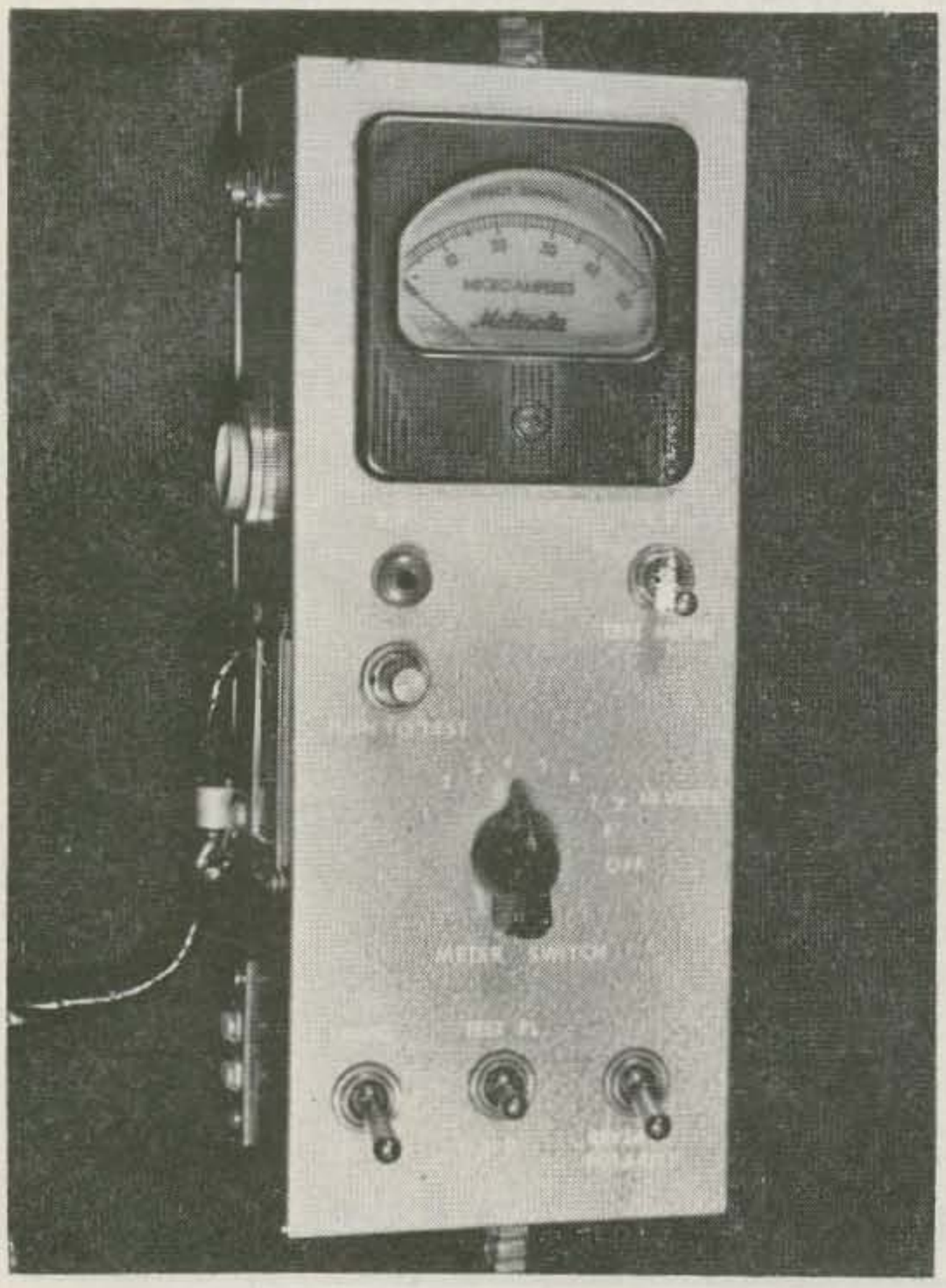


Motorola Test Set

Beryl Dassow W9HKA
RFD 2, Clifton, Illinois



THE unit pictured is a handy gadet to have around on one's workbench while converting the popular FM two-way radio surplus equipment to the six and two meter amateur frequencies.

This used out-dated commercial gear is drifting into our amateur channels in an ever increasing rate and a simple switch box is certainly a welcome addition for alignment checks. A regular test set can be obtained for something a little over $150, however this is usually out of the question even to most Civil Defense organizations.

The unit as described was designed with the idea of checking the alignment of the Motorola 30-D and 5V units of which our local CD is equipped. The older 30-D units provide a meter switch and all that is necessary is a good O-50 microammeter. However the 5V and later units provide a 11 pin test socket in both the receiver and transmitter sections for external meter switching and hence the need for the switch box arrangement.

Other features of this unit are the push-to-test switch, microphone jack and rf jack for overall check of the transmitter output.

Many other ideas will no doubt come to the reader's mind particularly those who have spent some time in converting these units. For example, a transistorized crystal oscillator could be wired in for checking purposes. The external speaker could be mounted internally by using a larger box.

While a meter movement of a higher basic range may be used with almost equal results, the O to 50 microammeter will give similar readings as described in the Motorola maintenance manuals.

(Continued on page 50)

Ham Headlines

If ham radio makes the newspapers in your town please send a clipping to Marvin Lipton VE3DQX, 311 Rosemary Road, Toronto 10, Ontario, Canada. Marvin runs the 73 News Service, a monthly publication sent to all editors of club bulletins. He will digest the most important stories that are submitted each month for us to print in 73.

HAMS AID BLIND BOY

(The Evening Bulletin, Providence, R. I., submitted by W1MUZ) H. Raymond Alexander, Sr., K1GRG, was the first to transmit an appeal for funds that would be translated into a receiver with Braille dials and knobs for a 12-year-old boy; Roy Sassi. Approximately $80 of the $600 sought has been raised to date for the fund which closely resembles a drive held about 2½ years ago, when a 9-year-old girl, requiring 136 skin grafts, received 2½ tons of QSL cards from well wishing hams.

BRITON HEARS RADIO WARNING TO SELASSIE

(Daily Mail, England, submitted by G2DHV) First news of the Ethiopian coup was received by John Turrell, G2CBN, on his 10 tube, eight year old, 25 pound receiver. Crashing through the chirping of Billy, John's budgerigar, came the message on 15 meters "CQ CQ de ET3XY. Inform his Imperial Majesty the Emperor now in Brazil, that a coup d'etat has taken place." Ethiopian officials in London were notified immediately.

HAM GUIDES DRUG TO CHILD IN BUENOS AIRES

(The Evening Bulletin, Philadelphia, Pa., submitted by J. Rosenwald, 2nd) Albert Fernandez, 41, of Croydon, picked up an emergency message being flashed over South America and came to the rescue of young Maria Graniselli, critically ill in hospital in Buenos Aires. Fernandez contacted a doctor in the Lower Bucks County Hospital, who in turn arranged to have a new antibiotic drug rushed to Argentina by air. Within 24 hours the girl had received the medicine and responded to it.

W6 ALERTS F.B.I. WITH ILLEGAL RIG

(San Diego Daily Press, Calif., submitted by Hugh Compton, W7MKW) James P. Green, 18, of San Diego, Calif., a freshman at College and ham operator planted an unidentified, radiating rig on Mt. Solebad causing a general alarm in the area. After a 5 day search by the F.C.C., C.D., and F.B.I., the intermittent signal source was located. The youth, who was not taken into custody, was quoted as saying that he hid the rig "to test our emergency network against enemy jamming." At last report the F.C.C. was considering punitive action regarding the misdemeanor. . . . VE3DQX

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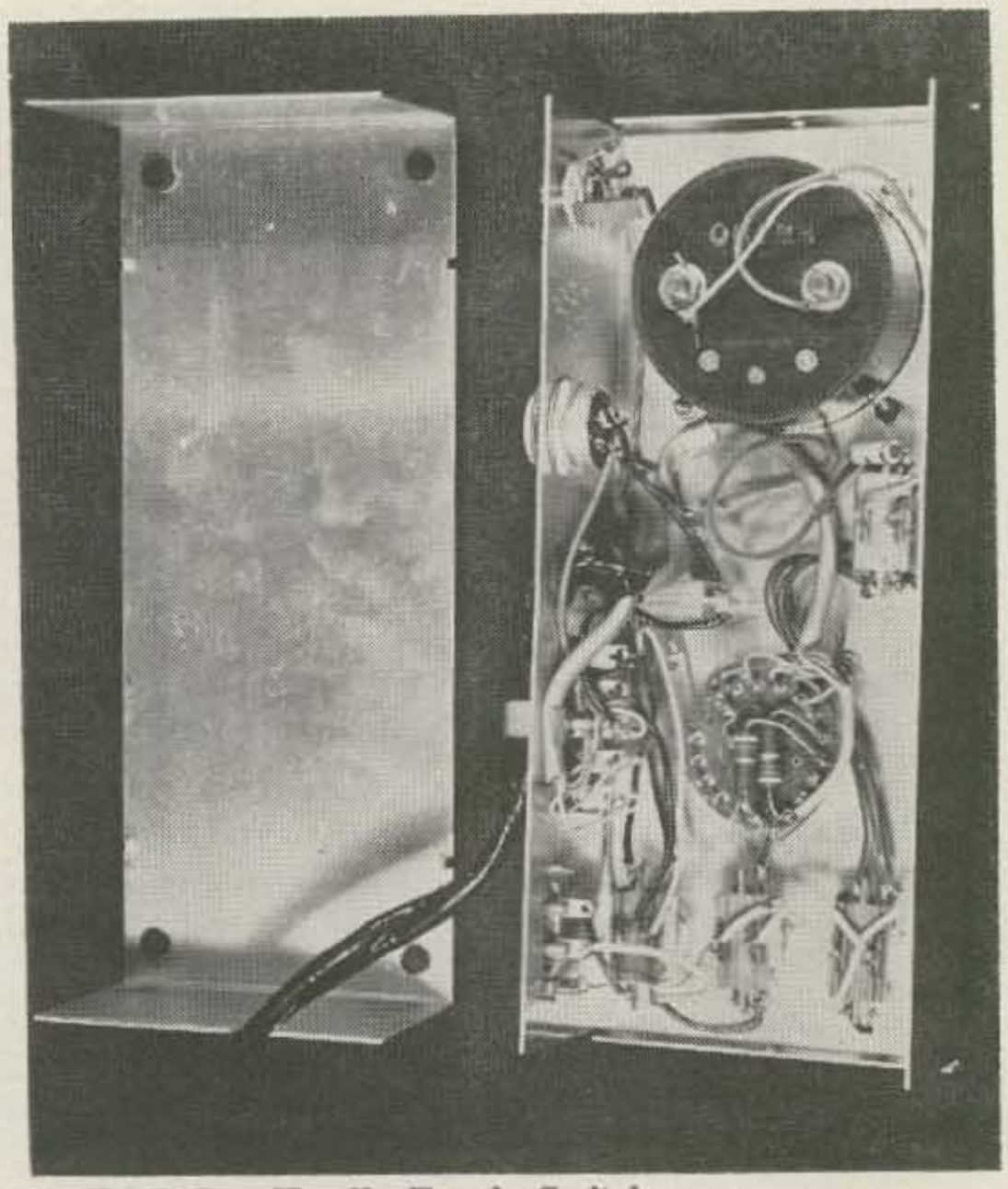
(Continued from page 48)

In order to determine which position of the selector switch corresponds to what section of the circuit under test, a small name plate holder is affixed to the side of the cabinet with the following information.

Receiver	Transmitter
#1—3rd IF Grid	Modulator Grid
#2—1st Limiter	1st Quadrupler Grid
#3—2nd Limiter	Tripler Grid
#4—Disc. (Sec)	1st Doubler Driver
#5—Disc. (Pri)	Doubler Driver Grid
#6—Multiplier Grid	P. A. Grid
#7—Blank	P. A. Plate
#8—Blank	B Plus

The actual method used in aligning these units is beyond the scope of this article. All parts are mounted as per the usual construction practices. The rotary switch as shown in the photograph happens to have more contacts than required but does afford an easy tie place for the two multiplier resistors.. These two resistors were simply selected to give approximately two-thirds scale reading when reading the high voltage. The 30-D to Test PL. switch needs only to be a SPDT instead of as shown in the photograph. The small fuse clips on each end of the box are used to hold the test plug cable when the unit is not used. 73



Parts List

1—0-50 microammeter.
3—DPDT Bat Handle Toggle Switches.
1—SPDT Bat Handle Toggle Switch.
1—SPST Momentary Push Switch.
1—9 position rotary switch.
1—Single circuit 'phone jack.
1—Banana Jack for RF input.
1—2-terminal board for external speaker.
1—11 pin socket (amphenol 78S11).
1—11 prong plug (amphenol 86-CP11).
1—4 contact mic. socket (amphenol 91-PC4F).
1—1N34 diode or similar.
1—20K ½ watt resistor.
2—4.7 megohm 1 watt resistors.
1—Minibox (10 x 4 x 2½).

Chassis Mounting the PL-259

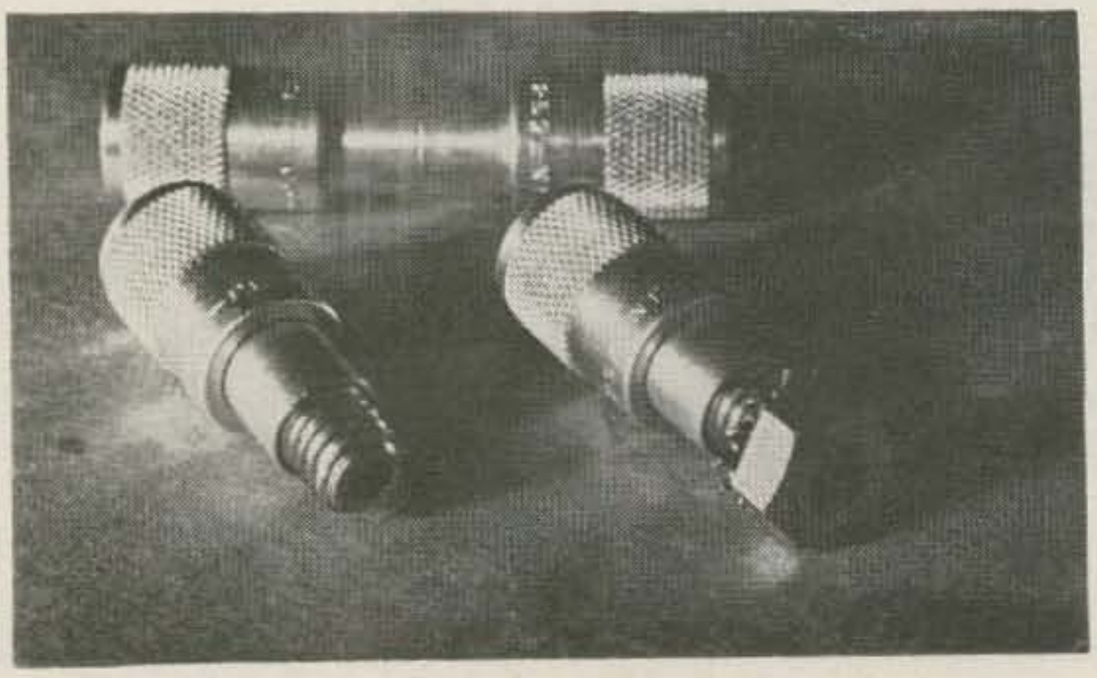
THE UHF series of coaxial connectors, typified by the PL-259 plug and the SO-239 chassis receptacle, is widely used on both commercial and military equipment. Also, these fittings are still readily available, at reasonable cost, from surplus outlets.

It is often desirable to support small chassis mounted accessories, such as TR switches, by the coaxial connectors mounted on existing equipment. This generates a requirement for fittings that are not available as standard items. It is possible to mount later production PL-259 plugs on a chassis by using a standard National Coarse thread cap screw. A hex head, 7/16-14 brass bolt, about ½" long, is ideal for this purpose since the threads mate perfectly with the cable retaining threads in the plug body. A clearance hole for the connecting lead, up to 5/16" in diameter, should be drilled the length of the bolt. A lock washer should be used for secure mounting.

The second item that can not be obtained commercially is a double ended male plug. Such a fitting is ideal for mounting an antenna changeover relay directly on a transmitter antenna receptacle. A short stud, about 1" long, cut from a 7/16-14 brass bolt, serves as a perfect coupling for joining two PL-259 plugs. A clearance hole must be drilled the length of the stud to accommodate the wiring.

The photograph shows the assembly details of these fittings, along with the finished double male adaptor. This method of construction does much to alleviate the haywire maze of cables that always seem to complicate even the simplest installation.

. . . Pafenberg



New Products

. . . the editor

Anybody who thinks about it for a moment will realize that only in short-lived magazines do you find New Products reviews which tell you how terrible things really are. The normal function of the New Product Review is to inform the reader and butter the advertiser.

We endorse both of these policies and must also confess to a third: the editor likes to write about what is going on in the commercial end of our hobby, but doesn't want to upset advertisers by lumping everything in the editorial column.

The response has been so enthusiastic to some of our construction projects that little knots of amateurs have been gathering all around the country discussing the possibility of putting some of them on the market. One new company is called Gidgets and Gadgets, as unlikely a name as we've heard recently, and they're already putting out kits of parts for the W9DUT Bantam Converters and K8NIC's 6M Transmitter, both of the October issue of 73. They're hard at work getting some more kits ready. Just in case they run into any obviously lazy customers they have made arrangements with a couple of experts to wire the kits for a few bucks extra.

You might know that something would be brewing out California way along this line too. A call came in from P.G.B. Electronics saying that they were working along similar lines.

Irving Electronics, down Texas way, will be preparing printed circuit boards for any articles we run. Right now we're getting a p.c. noise limiter circuit ready for the next issue of 73. You ought to send for the catalog of p.c.'s Irv has available, you'll be amazed and enthused.

Can anyone tell us how in the devil Allied can sell a complete six meter transceiver, complete with mike, for only $57.50? It just doesn't seem possible! A superhet too.

I got to reading some of our own ads and the first thing you know I was driving over to visit Russ Spera W2UFU and talking deals over one of those URA-6 Teletype converters. After much haggling we settled on full list price and set about fitting the three racks full of gear in the back seat of the Porsche. Made it, but it was a tight fit. Now if there was only time to get it hooked up! I wanted to see Russ's stock of surplus, but the store was so full we couldn't even edge our way in to see what was there.

(Continued on page 52)

USE A
P&H AUDIO COMPRESSOR

FOR MINIMUM DISTORTION
MAXIMUM TALK POWER

100% MODULATION—WITHOUT DISTORTION is practically impossible to attain with most ham rigs. NOW—Thanks to P&H—you can have your cake and eat it too!

Simply connect a P&H MODEL AFC-1 or AFC-2 between the mike and the mike input of any SSB, DSB, AM, PM or FM transmitter—Set the transmitter audio gain control for 100% modulation and FORGET IT! From a WHISPER to a SHOUT—the compressor output level NEVER VARIES MORE THAN 6DB. May also be used on PA systems to maintain high audio output without blasting.

NOT A CLIPPING DEVICE! This is an AVC type compressor, like broadcast stations use. Operation is instantaneous, with no pumping effect. Built-in audio filters and SEPARATE HIGH and LOW IMPEDANCE CIRCUITS.

HIGH IMPEDANCE threshold is set at —52 DB and will provide up to 50 DB of compression with negligable distortion. LOW IMPEDANCE threshold is set at —25 DB, and will provide up to 40 DB of compression when used between the speaker and the audio output of a receiver; resulting in excellent AVC action from receivers with poor RF AVC characteristics.

MODEL AFC-1 (3" x 3" x 5") requires an external power source (often available from transmitter or receiver) and contains a 90-3500 cycle bandpass audio filter.

MODEL AFC-2 (5" x 5" x 7") has a built-in power supply and a switch controlled BROAD-MEDIUM-SHARP audio filter.

MODEL AFC-2CW is identical to the AFC-2 except for much sharper audio filters. It is intended for use with filter type exciters and for CW reception when used in the speaker line of receivers.

MODEL AFC-1 With tubes (less power supply).....$32.95
MODEL AFC-2 or AFC-2CW Complete $54.95

P&H ELECTRONICS INC.
424 Columbia Lafayette, Ind.

GIDGETS & GADGETS

as you can see in the column to the left, is a new company set up to make available complete kits of parts for construction articles appearing in 73.

Bantam Converters (specify band),
W9DUT (Oct. 73) $22.50
6M Transmitter, K8NIC/5 (Oct. 73) $22.50

All kits are absolutely complete: punched chassis, copy of article, xtal, tubes, wire, solder, etc., and anything else we can think of that will help. All prices postpaid. Lucky NYC dwellers add 3%.

GIDGETS & GADGETS
P.O. BOX 117 FOREST HILLS 75, N. Y.
Lazy? Add $7.50 for unit wired and tested.
Watch for even more of these kits next month.

(New Products from page 51)

One of our inquiring reporters stuck their nose into Barry Electronics and discovered a couple interesting surprises. First of all the 1961 Barry Green Sheet is off the presses and is guaranteed to make any red blooded ham drool. This and the new International Crystal catalog rate as the best literature of the new year that we've seen for the home-brew type ham, excluding the 440 page reference work put out by Allied.

Alden Products informs us that several of our readers haven't yet bought their operating bench. This we can only ascribe to an oversight. You must have forgotten to send for literature and see what a deal they have. Or maybe you don't care what your shack looks like. This is one of the nicest operating tables we've ever seen.

Shure

A letter came rolling in the other day from Mr. H. T. Harwood, the Advertising Manager of Shure Brothers. Mr. Harwood explained that he had arranged to send me, compliments of Shure Brothers, and at the request of Bill Simons W9YXJ, a model 440SL Single-Sideband Microphone.

Well, here it was. I'd been fearing the day when someone would send something directly to me for a "test." I put the letter aside and tried to forget it. Then, a day later, it arrived. With a sinking heart I could feel all my altruistic plans disintegrating as cupidity took over. I wanted that microphone. I opened the box and screwed the mike to the stand . . . I had to have that mike . . . gad, what a beauty! I felt all the symptoms of drug withdrawal every time I even thought about sending this fabulous mike to someone who could do an adequate job of testing it.

The rationalizations came thick and fast. What kind of a test can anyone do on a mike anyway? About the best you can do is repeat the manufacturer's literature and give the output level and frequency range. Beyond that all you can say is that you used it on the air and the fellows said you sounded good. Shure would be satisfied with a simple new products release, I wouldn't even have to dummy up a "tested" report.

So far I had been able to avoid all this mental torture by having equipment shipped directly to other hams for them to test. As long as it didn't get into my hands I didn't feel too bad. Well, I felt bad . . . but I could stand it. There were times when it got rough . . . for instance when Don Smith W3UZN sent in a photo of his station with a Heath Tener, Sixer and Twoer all stacked on top of one another. That was traumatic. I really wouldn't mind other fellows getting all that gear free . . . if I just didn't know about it.

So here I am with a brand new desirable mike. I don't know why it bugs me so . . . after all, I already have a perfectly good mike that I've been using for five years now . . . a little Shure hand mike that I won out at the Dayton Hamvention in 1956. I suppose that I might part with the new one . . . probably give me nightmares. Tell you what, I'll put together a quick New Products Review for this issue of 73 and then we'll offer the mike as a prize to the sideband op that sends in the most subscriptions by April 5th. One catch . . . the winner has to use the mike on the air and send me a letter telling what the reports were on it. How's that? Boy! I feel better already . . . but gee, I'm sure going to miss that peachy mike.

New Books

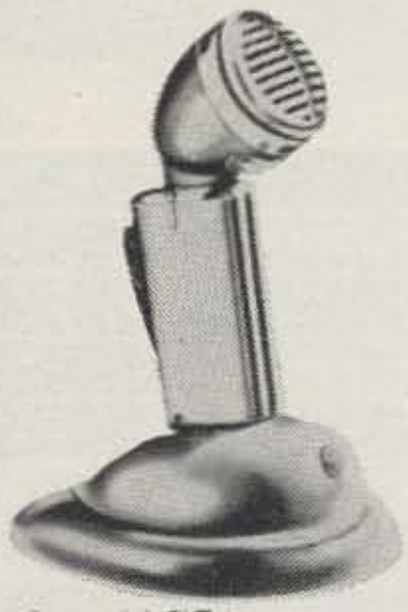
One of our most consistant contributors, Howard Pyle W7OE, has just become the proud author of a Sams Photofact book (NHP-1) called **"Building Up Your Ham Shack."** This is a fine book for the newcomer to our hobby for it will acquaint him with what he is going to need in the way of equipment and will put things into perspective. There is a chapter on receivers, one on transmitters and one on antennas. This is a well illustrated 128 page book and sells for only $2.50. This book will probably be available through most parts distributors and the Radio Bookshop.

Gernsback Library has just come out with a book that I would have really enjoyed when I was ten to fifteen. It is called **"Fun With Electricity"** and it has a bunch of experiments that you or your kid can have a ball with. The price is $2.65 (GL-83.) This shows you how to make a simple dc motor, an ac generator, a solenoid, a spark coil, a Tesla coil, etc. Literature like this around the shack might get more of a rise out of the jr op than anything else you've thought of.

Sams has a new book on **"Eliminating Man-Made Interference"** which will solve problems for a lot of hams. A lot of us run into this misery now and then and wish for some text to help us through the difficulty. This is the newest (and the only, to my knowledge) reference on the subject now available. $2.95. The book is quite thorough . . . 160 pages.

Another of our authors has been sneaking some time away from his 73 writing. The result, published by Sams, is the **"Second-Class Radiotelephone License Handbook"** by Edward Noll W3FQJ. The $3.95 book has everything you'll need to get the license. This is a lot more than the usual question and answer manual, with almost half of the book devoted to general information and technical discussion. The other half covers the actual exam and gives details on regulations. Thus the book not only will shepherd you through the FCC exam, but will give you practical operating and maintenance data to start you in the field.

New Shure Mike



Here is a mike that is designed specially for SSB ops. It has sharp cutoff below 300 cps and above 3000 cps, making it ideal for ham communications. It is rugged, being of magnetic design, and won't boil away in the sun or disolve when it rains. Output is —52.5 db at 100,000 ohms. For $28.50 the Model 440SL comes complete with grip-to-talk switch, mike stand and cable. Same deal, marked Model 440, less stand, switch and mike connector is only $15!

Call-D-Cal

I've seen these decals advertised for the last few months, but I hadn't realized what a nice looking deal they really are. They are 8" long by 4" high and are beautifully colored: gold letters outlined in yellow, red number outlined in gold, and a blue state with a black shadow behind it. This will stand out fabulously on the rear window of your car. You can have a world design instead of your state if you wish. Price is only $1.95!

On The Air

One of the minor little jealousies down through the years between amateurs and broadcasters has been those little (and very expensive) signs which light up and announce you are on the air. No wonder then that there has been quite a rush to take advantage of a small outfit down Texas way that is offering professional-looking signs at Novice prices: $6.95 complete. These are professional enough so a lot of broadcasting stations have been laying in a supply. They are 10½" long, 3½" x 3" deep. You can get 'em with 6, 12 or 120 volt bulbs. For a dollar extra you can get your call letters instead of the "On The Air" message, or you can get it in some other language, or think up something clever of your own. All kinds of possibilities.

. . . W2NSD

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The LW-51 Deluxe

$57.50

Features:

- 50 watts input, fully neutralized
- Uses inexpensive 8 mc xtals or VFO
- Plate modulated for efficiency and punch
- Input for crystal or carbon microphone
- TVI-proofed even in Channel 2 fringe area
- In kit form to cut costs
- All hard parts mounted (over 100)
- 6 or 12 volt filament
- Speech clipping & limiting for max modulation

Order Direct:

LW-51 Deluxe kit, less tubes & xtal	$57.50
LW-51 Deluxe kit, with tubes & any xtal.	69.50
LW-51 Deluxe kit, wired & tested	84.50
Ship weight 7 lbs.: 77c East Coast; $1.59 Western.	
LW-72 AC Power Supply, LW51 companion, wired	49.95
LW-61 VHF Converters	18.50
LW-80 Pre-Amplifiers	12.50

LW ELECTRONIC LABORATORY

ROUTE 2 JACKSON, MICHIGAN

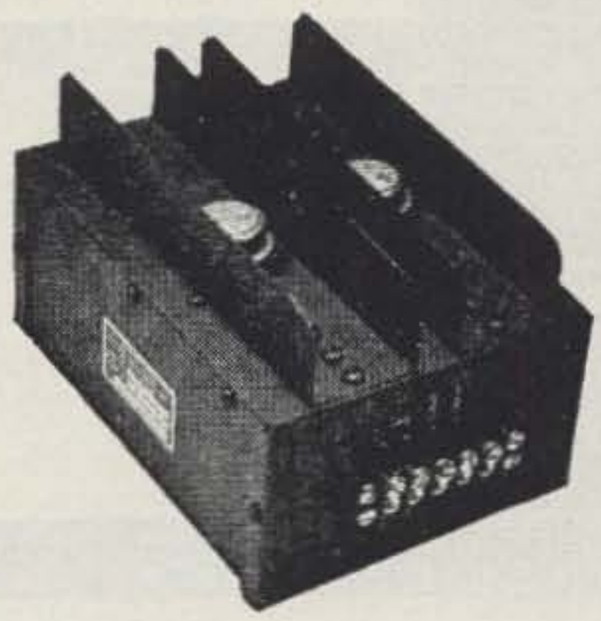
MOBILE POWER SUPPLY

MODEL

A12/600/200

NOW

$59.50



This 12V input dc to dc transistorized converter is conservatively rated for continuous output of 120 watts at 600V or 300V, or any combination of 600 and 300 volt loads totaling 120 watts.

High efficiency, small size, and light weight, plus freedom from maintenance, conserve your battery and increase the enjoyment of mobile operation.

GLOBE

ELECTRONICS DIVISION

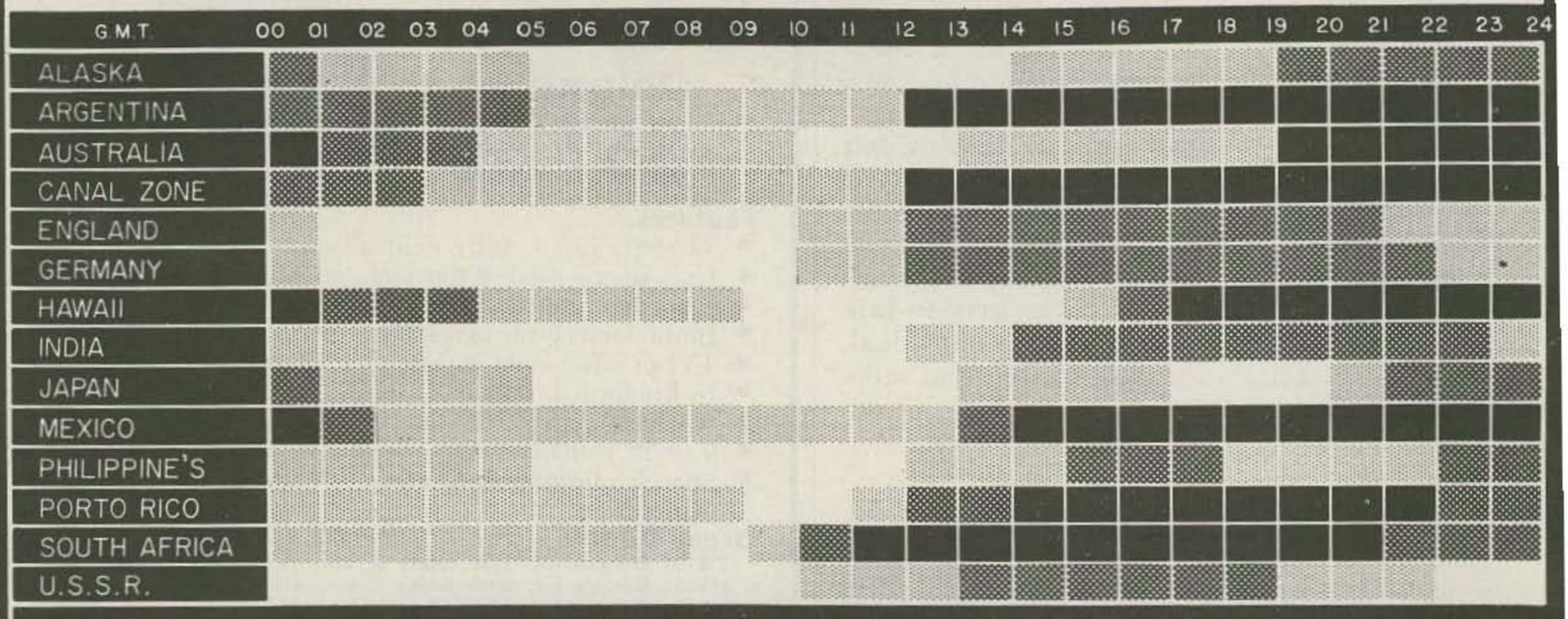
GLOBE INDUSTRIES, INC.

525 MAIN STREET

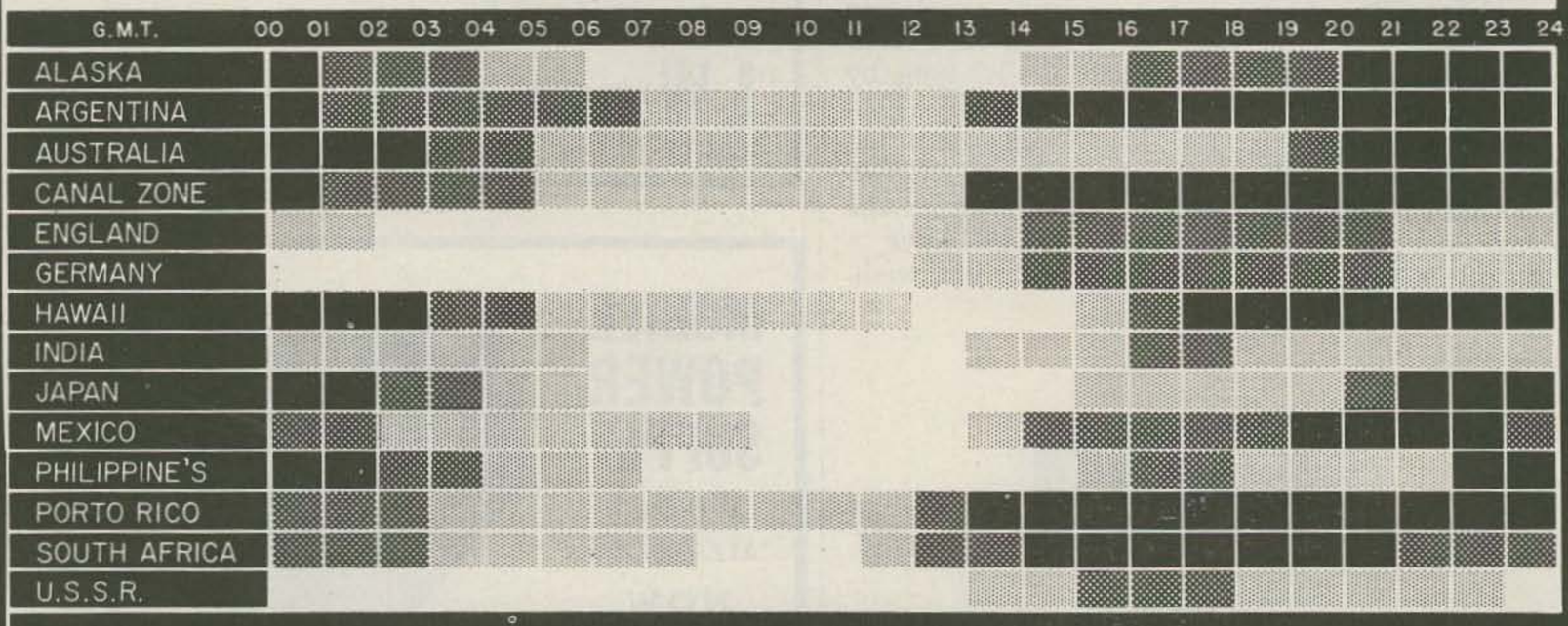
BELLEVILLE, NEW JERSEY

PROPAGATION CHART

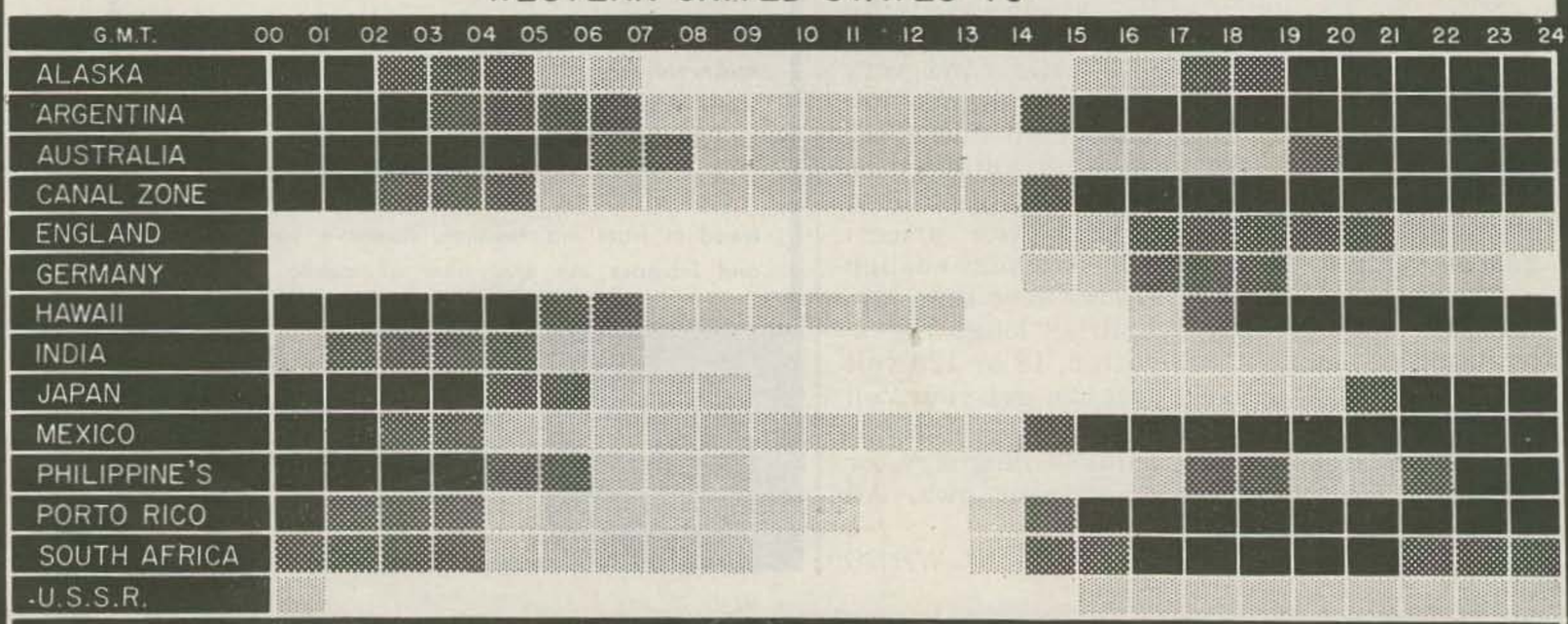
EASTERN UNITED STATES TO:



CENTRAL UNITED STATES TO:



WESTERN UNITED STATES TO:



LEGEND 7 MC 14 MC 21 MC 28 MC

Propagation Charts

David A. Brown K2IGY
30 Lambert Avenue
Farmingdale, N. Y.

The bands listed are MUFs and a higher band will not work for the time period listed. Lower bands will work, but not nearly as well. Times are GMT, not local time.

These charts are to be used as a guide to ham load openings for the month of March, 1961 to the various countries listed. I will be interested to hear of your results in using these charts and to know what other areas you might wish included in future charts.

Advanced Forecast: March 1961

All good except

Fair 5-6

METERS! METERS!! METERS!!!
TWO 73 SPECIALS!—
0-300 v, ac, 4" face, square..... **$3.95!**
0-100 ma dc, 2" or 3" round or square.... **$2.95!**
Be the first to take advantage of us at these prices—a fraction of the going prices for these new meters! While they last!
Thousands of other surplus items in stock. Many exciting bargains. Get
SURPLUS AT ITS BEST
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Now! Johnson Messenger **$134.95**
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BOSTONIANS!
Arise! You're surrounded by Bob Graham W1KTJ. Skeptical? Well, look for yourself. Visit either of the Graham stores and see nothing else but new and reconditioned ham gear at New England's *only* exclusive ham stores. It's worth the trip.
North of Boston at
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Phone: 944-4000
South of Boston at
1105 N. Main, Randolph
Phone: WO 3-5005

MESSAGE TO NON-SUBSCRIBERS: S U B S C R I B E !
Distributors tell us over and over of the dozens of fellows who come in time after time looking for a copy of 73. Gloryowsky! If you would spend a fraction of all that effort and mail us a miniscule check you'd make both of us a whole lot happier. Back issues are getting scarce: include 50¢ each, while they last.

Name ..... Call ..... $3 yr.
Address ..... $5 2 yrs.
City ..... Zone ..... State ..... $4 yr. DX
.... years. Start with ..... issue.
73 Magazine; 1379 East 15th St., Brooklyn 30, N. Y.

Name ..... Call ..... $3 yr.
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.... years. Start with ..... issue.
73 Magazine; 1379 East 15th St., Brooklyn 30, N. Y.

Names, 'Sines' and 'Handles'

Howard S. Pyle W7OE

". . . the handle here is Sebastian; what's your name old boy?" Bad enough on phone but imagine spelling it out on CW! Yet there are many just as tough to transmit and for the receiving operator to interpret. Names like Jim, Joe, Doc, Tom and even Bill and other simple one-syllable contractions aren't too bad but they too can be even simplified a bit. Intermediate names, generally of two syllables like my own, are not too much of a problem either but, particularly in CW operation, still a bit long to spell out. For example, ". . . handle here is Howard". Eighteen code characters to transmit. I seldom use it; my customary procedure is to say ". . . sine YB . . .". Only *six* characters but it tags me as an individual apart from my station call which is issued to cover the gear itself, *not* the operator! My *equipment* is W7OE; *I'm* not! I'm "YB", owner-operator of *station* W7OE. You wouldn't introduce a shipboard operator to someone by saying, "This is KURS (or whatever his call letter might be) would you? Nor a broadcast station operator by the call letters of the station at which he works. More properly, you would say, "This is Dick *of* KOMO". The same in ham practice; informal introduction of myself for example, would not be, ". . . this is W7OE"; correctly it would be something like this . . . "this is YB *of* W7OE". See the point? Nevertheless tradition and long usage has tagged the *individuals* with the call letters of an inert bunch of equipment rather than a more personal identification. Nothing wrong with it I suppose as the vast majority of ham stations are manned by only one operator who, in most cases, is the station owner as well. The practice will no doubt continue; it has gone on for too many years now to change overnight.

"Shades of Emily Post" some of you will say, "are you trying to tell us that we must observe formal social custom rather than the somewhat looser camaraderie of ham radio?" Not at all; handle it any way you like. All I'm trying to do is to point out a few usages in connection with individual identification which, while not necessarily confusing to the ham, can be improved upon both on-the-air and in face-to-face (I *hate* the expression 'eye-ball') QSO's. In addition, I'd like to attempt to clear up the apparent mystification which so many hams have when some relatively 'old-timer' casually says ". . . sine hr XX . . ." or some similar group of two letters. Let's find out what this "sine" business is all about . . . shall we?

As far as I can determine (I'm not *that* ancient, you know!), it all started shortly after Sam Morse invented the electric telegraph in the middle 1800's. Messages were soon flying (well, stumbling anyway!) along the thin copper threads stretched from pole to pole and from city to city. As the telegraph began to prove increasingly practical and speedy, messages became of increasing importance. Often messages were filed which dealt with impressive transactions, financial and otherwise. An improperly sent or received message could, and frequently did, involve serious losses to either the sender or recipient or both. Often the telegraph company had to 'take the bump' in the way of lawsuits which very often proved plenty costly. They in turn cast about for some means of recovery from the operator or operators on their circuit who were responsible for errors in transmission or reception or both. But *what* operator(s)? Telegraphers changed shifts, swapped around and added to the confusion of identification in other ways. Recovery of any financial loss from an operator due to his error was, of course, a rather forlorn hope on the part of the telegraph company. Telegrapher's pay was low and, in the early days, a good many of them were "drifters" and pretty good examples of the old adage, ". . . a rolling stone gathers no moss . . .". Nevertheless the telegraph companies decided to attempt to do something about it; thus the "sine" was born. Where the spelling originated is anybody's guess. It is pretty obvious thought that 'sine' was probably a contraction, speaking code-wise, of the word 'sign'. You 'sign' a receipt, a letter, a check and by so doing acknowledge it. Telegraph operators were required to sign for each message received by making their 'signature' in code characters. The *sending* operator was required to place *his* signature on the face

of each message he transmitted.

Often, signatures were long . . . you know, "George Washington, Evelyn Belideau, Ben Franklin . . . " (had they been operators) took valuable circuit time to write. It was not long before merely the *initials* of the operators were substituted. Often this caused confusion where two or more operators in the same office might have the same initials. To offset this, a couple of letters which did not conflict with others, were arbitrarily selected. George Washington might remain 'GW' without conflict, but maybe Evelyn's initials (EB) might clash with Ed Baker's. So . . . Evelyn probably became 'EV' while Ed retained his 'EB'. Maybe Ben Franklin kept his but he could conceivably have run into Bob Freeman who was already using 'BF' as a 'sine'. One or the other changed; usually the junior man at that office. Whatever they turned up with became the operators' signature or 'sine'; the contraction from 'sign' to 'sine' saved two dashes in transmission when some operator asked for your sign or merely said "WO" which, in telegraphic phraseology, sent on Morse lines as 'dit dah dah; dit space dit' (in continental code it's 'dit dah dah space dah dah dah) meant "Who ?".

The practice of arbitrarily selecting a group of two letters, your initials or otherwise as circumstance dictated, soon achieved international recognition as telegraphic 'signatures' in the operating field. An operator kept his 'sine' throughout his telegraphic career regardless of where he moved. *Unless* . . . he accepted a job at an office where some other operator was already using the same sine. In such cases, they squabbled it out among themselves and the office manager based mainly on who had held the sine the longest! When the losing operator moved on to some other office, he generally retrieved and used his temporarily lost sine.

When I started my Morse telegraph career as a student telegrapher in the Portland, Oregon main office of Western Union in 1916, my initials (HP) were already in use as a sine by a senior man. Being junior, it was incumbent on me to pick a sine not then being used. I chose "NX" as I liked the rhythm; NX in *Morse* code is the same combination of dots and dashes which make up the letters "NL" in Continental or International radio code.

Radio had always been my first love. Starting as a radio (or "wireless" as we then knew it) ham in 1908 at the tender age of ten years, the romance of the air waves continued to intrigue me. A Morse telegraph office to me was a humdrum of routine; same old place, same old faces every shift. I didn't stay long as a wire telegrapher. A shipboard job opened for which I could qualify as I had meanwhile acquired a commercial radio operator license. I snagged the job and took my sine with me . . . NX. Liking the rhythm of the *Morse* NX, I used the same characters; "dah dit dit dah dit dit". Using the Continental or International Morse code in the radio service, this combination of characters became "NL". That was it; NL became my sine in 1917 and stayed with me during merchant marine operating, at Naval radio shore stations and during a year on a Naval transport between the United States and Europe, during World War I. Mustered out of the Navy after the 1918 armistice, I returned to the merchant marine in the Alaskan passenger service, still keeping NL as a sine. Still later, as operator at a commercial shore station (KJA) at Jualin, Alaska, NL was still with me.

In the fall of 1919 I returned to Naval service and was assigned duty as an operator at the naval 'high-power' station, NVH, at Ketchikan, Alaska, still carrying NL as my sine. Trouble developed on my first watch! No one else on the station was using the same sine but the Ketchikan station, in addi-

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tion to handling much of the official naval traffic for Alaska, also handled a great deal of commercial radio message traffic to the territory (then, before statehood), sharing this with the Army Signal Corps cable and radio system. This involved the conventional 'fast' messages, day-letters and night-letters. The designation for a night-letter were the letters 'NL' following the check. Each time I'd OK for a message received from our sister station, NUZ, in Astoria, Oregon by using the standard form, "R NL" (meaning received OK by operator NL), I'd get a beef from the Astoria operator to the effect ". . . no, no; that's not a night-letter; it's a 'black' (fast) or a day-letter". Obviously my sine must be changed. I determined this time to choose one which had only a remote chance of duplication in my future operating career. Thus was "YB" born. I have since served as operator aboard many freight and passenger vessels and at a number of commercial shore stations. I have *never* since choosing "YB" for a sine in 1919, been in conflict with the sine of any other operator! I still use it in ham nets and in general ham communication, without challenge. I am in fact, known better in ham and commercial radio circles as "YB" than by my formal name. To answer the many mystified inquiries which I receive, the letters 'YB' do *not* stand for anything in the way of actual words. Call them "young boy", "yellow belly" or "you b - - - - - d" as you prefer but they have *no* real association with *words*. Like "SOS" which means 'distress'; *not* "save our ship" or "send us succor" and similar phrases invented by an imaginative lay public, "YB" means *me* as an individual!

I would most certainly encourage more frequent use of sines, self-chosen, on ham circuits, particularly CW. It shortens the number of characters in almost every instance and immediately identifies you as an individual. There are a few exceptions, of course such as using the nicknames 'Ed', 'Al' and similar. Nothing wrong with them for a sine; most certainly they are short enough although, as names go, rather common. Pick yourself a combination of two characters which appeal to you for perhaps rhythm, ease of sending or ready interpretation; make those two letters your sine and become known by them. You can drop the 'handle' or 'name' business then and do a more professional job of operating, even in the ham bands.

And that, dear reader, is that; I do hope it clears up the oft repeated question of 'what is a sine?'.

"73" de "YB"

Other Ham

RATHER than devote half or more of 73 to the printing of news of interest to specialized groups we believe that it is our function to do everything possible to encourage the publishers of bulletins which cater to these

HAM-SWAP. Published by Ham-Swap, Inc., 35 East Wacker Drive, Chicago 1, Illinois. Editor is Ed Shuey, K9BDK. Subs are $1 per year by 3rd class mail, $3 for 1st class, $5 airmail, and $7.20 special delivery. Published once a month. Contains classified ads entirely. This is your best bet for an inexpensive way to sell or swap some gear in a hurry. Within two weeks people are answering your ad.

FLORIDA RTTY BULLETIN. Fred W. DeMotte W4RWM, P.O. Box 6047, Daytona Beach, Florida. $3 per year including membership in Florida RTTY Society. Mostly operating news with a bit of technical info now and then. All TT men should be getting this.

SOUTHERN CALIFORNIA RTTY BULLETIN. Merrill L. Swan W6AEE, 372 West Warren Way, Arcadia, California. $2.75 per year, not including membership in Society. Operating news and some technical articles. This is the oldest TT bulletin going. All TT men should also get this one. Monthly.

73 HAM CLUB BULLETIN. Marvin Lipton VE3DQX, 311 Rosemary Road, Toronto 10, Ontario, Canada. Sent free to all editors of ham club bulletins monthly to keep them abreast of what is going on with all the other ham clubs. This is an excellent source of news for putting together your club bulletins. To subscribe to this news bulletin just send a copy of your own club bulletin to Marvin.

WESTERN RADIO AMATEUR. Don Williamson W6JRE, 10517 Haverly Street, El Monte, California. Monthly. Subs are $2 per year, $3.50 for two years, $5 for three years. Operating news of west coast activity, columns on DX, SSB, YL, and some articles. 48 pages.

SIDEBANDER. Official organ of the Single Sideband Amateur Radio Association, 12 Elm Street, Lynbrook, L. I., N. Y. Subs include membership to SSBARA: $3 per year. Monthly. Primarily operating news and chitchat for the SSB DX gang.

Publications

interests. These bulletins bring you the news you want in far greater detail and in much less time than is possible in a monthly magazine where it usually takes two months for news to get into print.

THE OLD TIMER'S BULLETIN. Published by Bruce Kelly W2ICE, Main Street, Holcomb, New York, four times a year. $1 per year. Pictures and discussions of old ham gear, old ham ops and old ham doings.

HAM-HOP NEWS. Published quarterly by the International Ham-Hop Club, G. A. Partridge G3CED, 17 Ethel Road, Broadstairs, Kent, England. 75¢ per year for bulletin, $1.50 full membership. Club devoted to arranging visits between hams and ham families all over the world.

VHF AMATEUR. Published monthly by Bob Brown K2ZSQ(T), 67 Russell Avenue, Rahway, New Jersey. $2 per year. Operating news for VHF'ers.

THE MONITOR. Mar-Jax Publishers, 507 West Davis Street, Dallas 8, Texas. $1 a year, 3 years for $2.50. Monthly. Largely operating news. Columns: YL, Club Meetings, Arkansas News, Mississippi News, Florida News, DX, Missouri News, MARS, California News, Louisiana News, VHF News, Oklahoma News, Rio Grande Valley News, Novice News.

DX-QSL News Letter. Clif Evans, K6BX, Box 385, Bonita, California. Published quarterly. 40¢ each; Annual subscription $1.25 (four copies) by first class mail ($1.50 for DX stations). Lists all QSL Bureaus, managers for rare DX stations, etc. Why not send your old Callbook to a DX ham? Write Clif for the name of someone who needs it.

DIRECTORY OF CERTIFICATES AND AWARDS. Clif Evans, K6BX, Box 385, Bonita, Cal. Complete Directory plus one year of revisions (quarterly) $3.50. Add 75¢ for 1st class mail; $1.25 for airmail; DX stations 1st class mail add $1.00. Needless to say, this is the most complete collection of data on the hundreds of certificates and awards available.

MOBILE NEWS. Published monthly by the Amateur Radio Mobile Society, 79 Murchison Rd., Leyton, E. 10, England. Joining fee and 1 year sub. is $2.50.

DX BULLETIN. Don Chesser W4KVX, RFD 1, Burlington, Kentucky. DX news in depth. Published weekly. 3rd Class mail $5 year; 1st class $6; Airmail $7.50. DX rates on request.

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IN recent years the myth that *it's cheaper to buy than to build* has been gaining acceptance as fact among a great many radio amateurs. Thanks to the prosperity which our country now enjoys, a large number of U.S. hams can afford to purchase the ultimate in chrome plated kilowatts, precision receivers and deluxe beam antennas. While attempting to emulate these fortunate fellows, less affluent hams resort to all sorts of ludicrous rationalizations in order to salve their consciences for spending so much on what is, after all, only a hobby.

Ozzie (short for Ostrich) Ham, the one who prefers to bury his head in the sand rather than to look at unpleasant facts, will tell you that his new rig set him back only $200. He neglects to mention that he had previously paid $150 for the transmitter he traded in on the new one and he happily ignores the $20 to $30 carrying charges he's going to donate to the finance company as part of his time payment.

Trade-in Tommy has convinced himself that, in the long run, home-brew equipment costs a lot more than factory built gear. He points out that nowadays it is very difficult to locate a buyer for a used composite rig. Furthermore, a dealer won't even consider such equipment as a down payment on a factory produced transmitter. Tommy prefers to overlook the fact that the parts from an old home built rig either find their way into a new transmitter or else they are stored in the junk box for future use. True, these parts won't bring much at resale, but to the ham who owns them they are just as good as money in the bank. Maybe even better, if you weigh inflation caused price advances against bank interest rates.

Cautious Kenneth naively assumes that a kit or a factory wired piece of equipment is bound to put out a superior signal that won't get him in trouble with the FCC. While this is usually true, a poor quality signal can be generated by a rig carrying a famous manufacturer's label. A friend of mine, for example, owns a $400 transmitter that wobbles all over the place when amplitude modulated on 40 meters. Another fellow I know also has one of these beautifully styled instruments. Because of TVI, he was put off the air by a visiting FCC inspector.

Almost every case of really objectionable splatter I've heard on the phone bands in the last 3 or 4 years has resulted from over modulation of one very popular transmitter model. Another well known product puts a truly obnoxious signal right in the middle of the 160 meter Loran assignment when it is supposedly tuned to 75 meters. So you see, even though a lot of engineering know how is behind the design of a commercial rig, now and then somewhere along the production line somebody goofs.

High Power Harry bought his costly commercial rig because it is rated at 2000 watts PEP. An old time AM'er, Harry didn't read the fine print which claims an output of only 300 watts on that mode of transmission.

Hurry Up Hal says he's too busy to build. He just can't stay off the air long enough to roll his own. Hal's forgotten that it's possible to derive a great deal of satisfaction from creating something with a soldering iron and a screw driver. In fact, building can be just as much fun as yakking on 75 with the natives of New Haven, Nashville or Nutley.

If you've read this far, you've probably concluded that I'm one of those miserable old die hards who spends most of his time writing nasty letters to ham magazines about the bumper crop of knob twisting nitwits who inhabit the amateur bands these days. On the contrary, I believe it is a privilege to live in a country where so many individuals can truly afford the finest manufactured equipment that money can buy. Furthermore, I'm proud that my chosen hobby is one which provides year 'round pay checks to hundreds of Americans who are employed by receiver, transmitter and antenna manufacturers. However, I do feel that a lot of newly hatched hams, the kind who've never wound a coil, held a soldering iron or built a beam, get too little pleasure for each dollar they invest in the radio game.

If you have a well padded bank account or if you live in a small apartment or a house

trailer where you can't find room to set up a modest workshop, factory built gear obviously is the answer to your requirements. On the other hand, if you must think twice before spending a dollar and if you can locate enough space for a small workbench somewhere in your home, I contend that it will pay you to consider the advantages of building as much of your ham gear as possible. What are these advantages? Among the more important ones are the following:

WHEN YOU BUILD IT YOURSELF YOU INCREASE YOUR STORE OF PRACTICAL KNOWLEDGE.—Some hams attempt to lord it over their Citizens Radio brethren by boasting of the difficult theoretical examination which must be passed before a license is granted. Actually, though, just about any halfway intelligent human being has the ability to memorize the contents of the *License Manual* and squeak by the amateur exam with a passing grade. In view of this fact, it is hardly surprising that so many amateur operators know little more about what goes on behind the front panel of a transmitter than do their mail order counterparts on the Citizens Band.

You can read all kinds of text books. You can commit to memory every word in the instruction manual that came with your commercially built rig. Nevertheless, until you've actually worked with parts and have assembled them into a properly functioning electronic device, you can hardly claim to be a well rounded master of the amateur radio art.

A ham who doesn't build is analogous to a chemistry or physics major who has never been inside a lab. It's true that the answers to most technical questions will be found in books. However, if you discover the answers while actually working with a rig you've constructed, yourself, the information you glean will take on added significance and will really stick with you.

As the home constructor assembles an electronic gadget, one piece at a time, he becomes familiar with the location of each part in his rig. During the debugging process which usually follows the completion of home built gear, the experimenter learns the effect of a little more resistance here, a smaller coil there, etc. He gets the feel of his equipment and therefore doesn't hesitate to dig in when something needs to be repaired. Unlike many "buyers," a "builder" is seldom overawed by the complex wiring so often encountered in today's receivers and transmitters.

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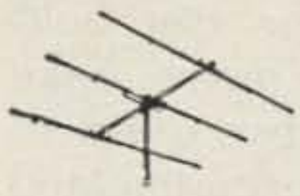

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EQUIPMENT.—Mass produced items must, of necessity, contain compromises between performance and price. Here is where the hobbyist has a distinct advantage. His labor costs nothing and if he's ingenious, he can hold component cost to a relatively low figure. Take for example VFO's. I've wired up two different VFO kits and have extensively experimented with a third. Not one of these approached in performance (mechanical and electrical stability, ease of tuning) a VFO which I built, myself, at a cost approximately equal to that of the least expensive kit.

I know a fellow who wanted an antenna with so much gain that it would put him way above the QRM and would provide consistent QSO's, even under the most adverse conditions. He had to build it, himself, because there is nothing in the catalogs that can approach its performance. You see it's a 10 meter Quad—with *twelve* elements.

HOME BUILT GEAR CAN BE TAILORED TO YOUR SPECIFIC NEEDS.—I wanted an effective beam that would cover 10, 15 and 20 meters. Because of nearby tree branches, no element could exceed 18 feet in length. Out of respect to my flimsy mast, the weight, including rotator, couldn't be much more than 10 pounds. To top off my requirements, the radiator, director and reflector must be tunable, by remote control, from the shack. The finished product met every one of my specifications at a cash outlay of less than ten dollars.

THE HOME CONSTRUCTOR NEED NOT PAY FOR UNNECESSARY FEATURES.—In order to please the varied tastes of prospective buyers, a manufacturer must include as many features as possible in the gear he markets. This may make for versatile performance, but it also adds to the selling price. I'm not interested in RTTY so why should I pay to have FSK built into my rig? I don't like VOX. For this reason, when I built my SB rig, I left out this annoying (to me) feature. The money I saved by the omission helped pay for other features that I wanted to include.

A FELLOW WHO BUILDS OBTAINS EXTRA PLEASURE FROM HIS HOBBY.—Whether you follow a circuit that has appeared in a magazine or design your own rig from scratch, once you have it completed and on the air, you'll experience a feeling of accomplishment that can never be enjoyed by the fellows who buy kits or factory wired gear. When a far off station comes back to a call from "your baby" you'll be filled with a pride that must be experienced to be appreciated. And when non-technical visitors come to the shack you can rightfully boast that "you made it, yourself."

HOME CONSTRUCTION GETS YOU OUT OF THE STEREOTYPED QSO RUT.—Have you really listened to the kind of QSO's that are prevalent today? A typical transmission goes something like this: "Rig hr's an FV300 feeding an NG47 beam with an XX22 for a hearing aid." That's all there is to it. No more description of the layout is required, because everyone knows just what these mass produced items look like.

When the home constructor goes on the air, however, this is not the case. Each piece of gear he's put together is a custom job. Even though much or all of it may have been copied from a similar unit, no other ham gadget is exactly like it. Consequently, a thorough over the air description is in order. This takes time and before you realize what is happening, a good old fashioned rag chew is in progress, since the boys involved are doing more than just spouting model numbers.

THE FELLOW WHO BUILDS HIS OWN DOESN'T SHY AWAY FROM CIRCUIT CHANGES.—The owner of a commercial unit seldom cares to make revisions that might adversely affect the resale value of his equipment. On the other hand, a home constructor has no such qualms. Whenever he wants to improve performance by trying out a new circuit, he merely plugs in his soldering iron and goes to work.

IT COSTS LESS TO BUILD THAN TO BUY.—Undoubtedly the most important reason for constructing your own ham gear, as far as the fellow with a thin billfold is concerned, is that by so doing you can save money.

About a year ago I decided to up-date my rig by adding a bandswitching final for CW, AM and SB. The amplifier I built is capable of 1000 watts PEP input as a linear. In Class C service it is rated at 500 watts CW and 400 watts phone. From the time I first thought of building the amplifier, until I had it completed and on the air, I paid out less than $8.00 for new materials. All the rest of the parts came from my junk box. Using today's ham logic, the entire amplifier cost me less than a penny a PEP watt.

Actually, some time in the past, I had to pay for most of the parts I took from the junk box. Thus, in order to fairly evaluate the total cost of the amplifier, the original amount paid for all components probably should be figured in. When this is done, the price tag reads $27.94. Even if I didn't have a junk box to rely on and had found it necessary to purchase every part

new from a current catalog, the price of the linear would be only $95.00. This is somewhere between ⅓ and ⅙ of the cost of a kit or factory wired amplifier with similar characteristics.

The true home builder, of course, seldom buys all of his parts at 40 and 2 off list. Instead, he is constantly on the lookout for bargains. He picks up usable tubes and transmitter components for a fraction of their original cost at ham club swap and shop sessions. He cannibalizes war surplus equipment for needed parts. He purchases small items such as resistors and capacitors in kits or by the pound. He carefully scrutinizes the ads in the back pages of ham publications while searching for low priced items. Even through the heyday of surplus, with its 50¢ beam rotators and 79¢ 304TL's is long gone, a fellow with a sharp eye can still save plenty of money when buying material for equipment construction.

WHAT ABOUT APPEARANCE?—Many home constructors lack the shop facilities and mechanical know-how required to give their gear that sleek factory styled look. This is, however, a rather insignificant drawback, because the fellow on the other end of a QSO isn't interested in the appearance of your rig. All he cares about is how it sounds over the air. By observing the rules of good engineering practice, the home constructor should be able to produce a rig that rivals or even excels the performance of the average piece of commercial gear.

Of course there is no law which says that home built equipment must have an amateurish look about it. Take the case of one of my friends. Although he owns a top notch commercial kilowatt, he still enjoys building accessories for his station. Recently he put together a keyer that is a superb example of craftsmanship. The unit works perfectly and yet it cost him only one third as much as the

(Continued on page 67)

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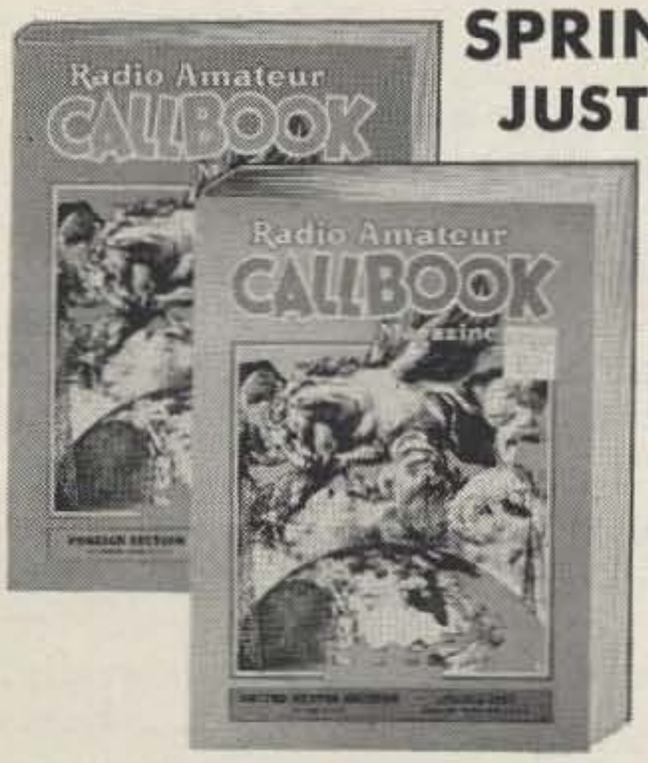

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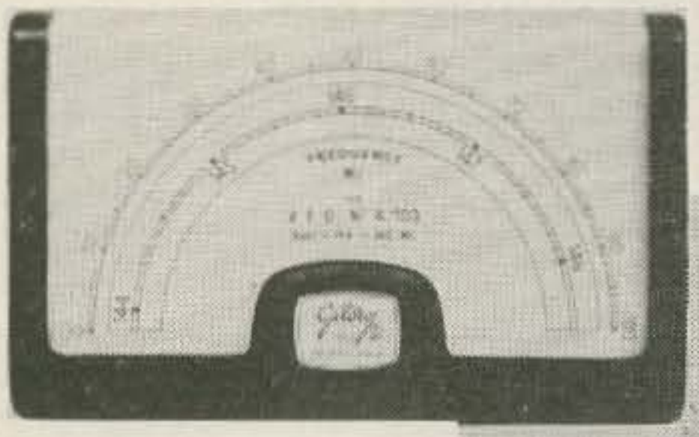

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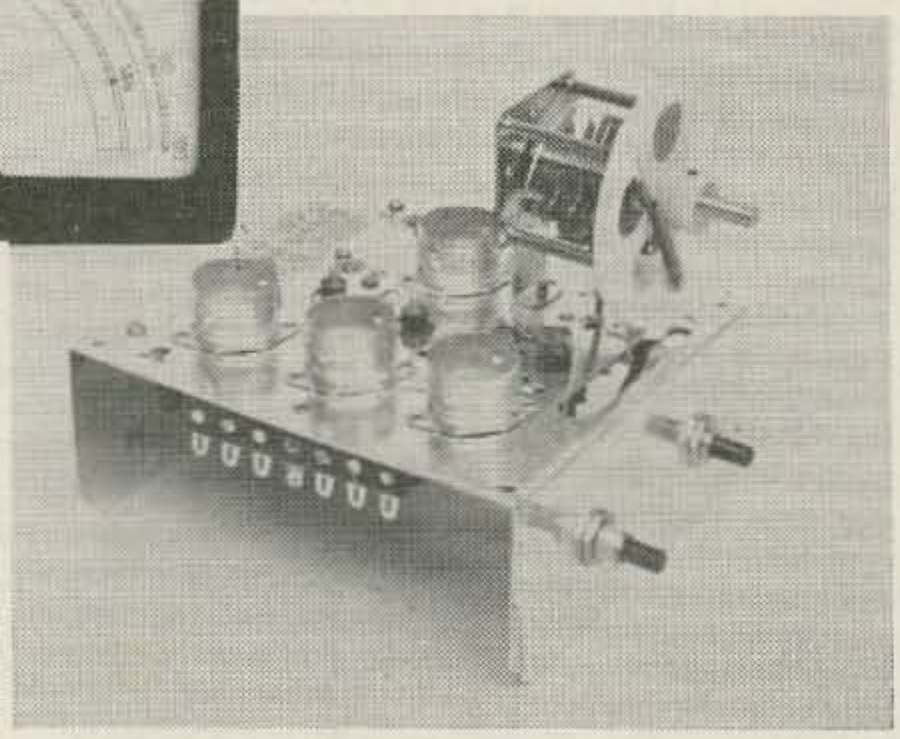

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Stable VFO or Xtal
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Wired ready to use, not a kit
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12 mc Xtals
Will drive an 832 or 2E26

This Geloso VFO makes an ideal exciter or low power transmitter. The VFO operates on 18 mc and is multiplied to 144 mc. The xtal osc. operated on 12 mc and multiplies up to 144 mc. Handy for nets, operating near band edges, CAP, MARS, etc. A set of tubes for the rig are only $6.75. Model 4/102 VFO, 5 bands (80-10M), assembled, wired, tested and calibrated. Will drive a pair of 807's or 6146's. Price, with dial, but less tubes: $29.95

PI Tuning Coils, complete with band change switch. Model 4/111 for use with parallel 807's or 6146's and Model 4/112 for use with single 807 or 6146 (60 watts). Tune 80-10 meters. Coil is 1¾" x 3¾" and mounts to 3¾" depth. Price for either: $4.95.

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This is a real fancy fuse. It costs a bit extra, but it provides safe protection for your gear without burning out every time you have a brief overload or a quick short. If the overload persists the Minitrip will blow out. They are available in current ratings of 100, 150, 200, 300, 500, 750, and 1000 ma. They will stand a 100% overload for about 45 seconds, a 200% overload for about 12 seconds, 300% for 7 seconds, and 500% for about four seconds. Currents up to 40 times the rated will be tolerated for a fraction of a second.

Minitrip . . . 69¢ each

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Relay, Sigma 4F 8000 ohms, 1 ma, 5 prong can	**4.75**
Relay, time delay, Westinghouse, 2 sec —50 min.	**6.50**

And this is just a tiny fraction of the interesting stuff I've got around. How'd you like to really see some lists of equipment and parts? Drop me a line or drop in and chew the rag. . . . Russ W2UFU. And hey, don't pass up that Geloso VFO, you'll love it.

(Continued from page 65)

factory made article after which it was fashioned.

WHAT ABOUT COMPACTNESS AND CONVENIENCE?—If you have the patience to design and redesign, and if you don't mind working in cramped quarters, you can come up with some pretty compact gadgets. In most instances, however, the average product of a home workshop is larger than its commercial counterpart. Although small size is often considered a virtue, under certain circumstances it is a drawback, especially when repairs become necessary. A lot fewer headaches are generated by rack and panel rigs with easily accessible components than by compact table toppers with their layer upon layer of parts squeezed into the smallest possible space.

CONCLUSION.—In spite of the great variety of kits and ready made equipment now on the market, and in spite of the convenience, compactness and excellent appearance of this gear, I believe that there is still a place in ham radio for the fellow who rolls his own.

If you want the best possible performance for each dollar expended—If you want a rig which boasts features not ordinarily included in manufactured gear—If you want a transmitter or receiver tailored to your own special requirements—If you want to increase your practical and theoretical knowledge of electronics, then try your hand at home construction.

I think you'll enjoy that wonderful feeling of accomplishment which comes only to those who operate equipment that they, themselves, have put together.

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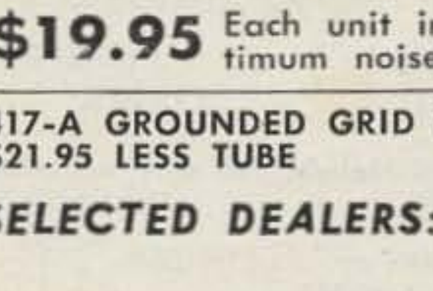

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Who . . When .

IT's fun to tell a QSO-pal: "don't you remember our first QSO on February 7th eight years ago, but friend, I haven't received your QSL yet. . . ." Well, we still 'remember' his name, his QTH, and maybe we can tell him some more details of that QSO, too. And the chap is amazed at our memory.

Well, here's the real truth: The contact really was eight years ago, but by my honor we didn't dig out the details from the final stage between our narrow shoulders. No, the info was picked up from the file system.

If you have no file system yet, here's one which certainly is interesting enough to get acquainted with. I do not aim to present this as the best and only one, but I have done well with it for some years.

Originally I printed a card quite different from this one. It had space for the call, name and QTH plus date/QSL for the first QSO on each band plus space for the date of every QSO. This was alright as long as I was operating only CW on the bands. However, the XYL got her ticket and wanted fone, so I had to change the cards. It became essential to reserve space for more details. Finally the present card was made to meet the requirements of any active amateur using any mode of transmission, CW, AM or SSB.

There are two sides printed of the cards. The cards are filed alphabetically according to the calls, and naturally the side with the call sign is kept in sight. So, here we go: Look at the Fig. 1. The 'box' in the upper

John, Helsinki — OH2YV

Bnd	SSB		PHONE		CW	
3,5						
7					1/1/51	x
14	11/9/59	x	12/8/57	x	8/9/58	x
21						
28	11/1/59	x			7/6/60	

right corner is reserved for the call sign of the station worked, the long space left from the call-box is for the name and QTH. That's enough to tell the chap: "gld cuagn." For simplicity I have taken my own call as an example. If you find the card in your file it means that you have contacted me before. If you don't, just take an empty card and fill it. So we QSO'd, and you see: OH2YV name is John and QTH Helsinki. Look still at the picture No. 1. You see we have con-

Where . . and How

John Velamo, OH2YV

tacted at least the following: CW on three bands (7, 14 and 28 mc), AM on one band (14 mc) and two-way SSB on two bands (28 and 14 mc). Good, and still you find out that you have received my QSL for all other QSOs except that on 28 mc CW.—i.e. on this side of the card you enter the first QSO on each band and in each emission type. The small 'box' is reserved for an "x" or a "y" or whatever you like to use, when the QSL for that very QSO has been received. So now you understand the system.

Turn the card over (Fig. 2). There is

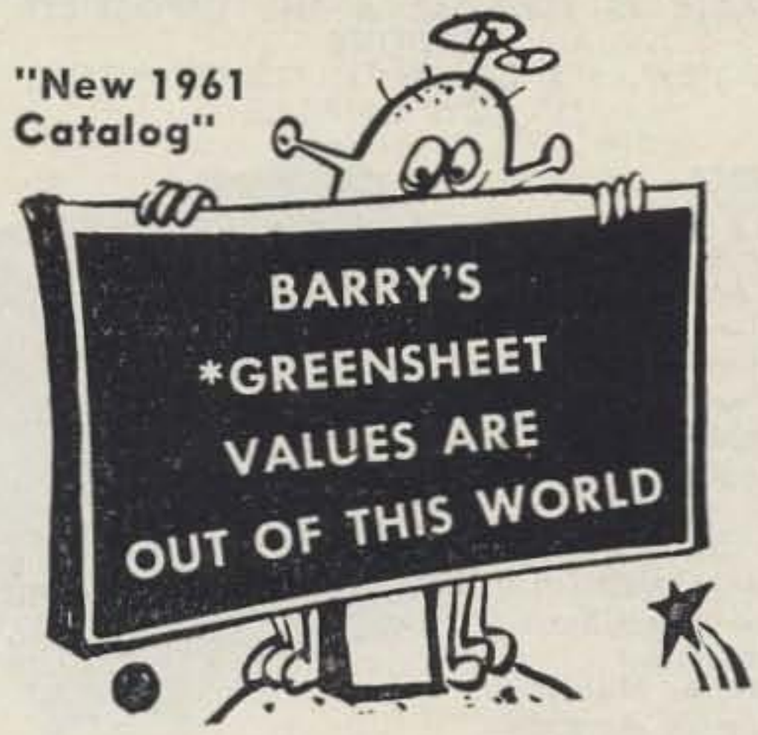
1.1.51	7	cv	12.8.57	14	fv	8.9.58	14	cv	11.1.59	14	sv		
11.9.59	28	sv	7.6.60	28	c								

space for 36 contacts. Here I write the details of *every* QSO, including even those on the title side. Here is space for date, band, emission type, and QSL received. For the emission types I am using following abbreviations: C = CW, F = AM Phone, S = 2-way SSB. Someone may think the 'QSL box' useless, but as an active "award hunter" I have found it essential because many certificates require the QSO to be made after certain date. Here you can check both the date and QSL. Use just any mark, myself I have used "v" when QSL is o.k.—As said there is space for 36 QSO's on this card. Actually there are not very many cases where I have got to take another card after the first one has been filled up to the 36. However, due to the limited space in my drawer I *had* to print these little cards (size only about 3" x 5".) If you have more space for the file print larger cards.

There is some spare space on both sides of the card for possible extra notes (club station operator names, power, etc).

Well, there it is. Now you know my "damned good memory." Anyway, you may be sure that the next time we meet I will not need to pick up your card to remember your name; good pals remember the names of each other without any files. Just for safety sake let me look at that card, however, hi.

Thanks for the interest! Hope you got an idea from this.



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(CW-RTTY from page 21)

rotary distributor contact and a single peaked cam which actuates an operating lever that advances the tape head one character for each shaft revolution. Two approaches to the problem bear promise. The simplest and the cheapest would be to replace the existing, single throw cam with a unit shaped to actuate the operating lever two or more times per revolution of the main shaft. The second approach, which is not easily accomplished or readily restorable, would be to increase the main shaft speed by the installation of special gears. The maximum operating speed of the tape head has not been determined, although the writer has heard reports of a 240 WPM modification applied to similar equipment.

In summary, the system as presented is workable and will meet a number of amateur requirements. The cost of the modification is negligible and the original utility of the equipment is not impaired. Further, the way is open for those with the inclination, equipment and time to increase the operating speed of the system. . . . Pafenberg

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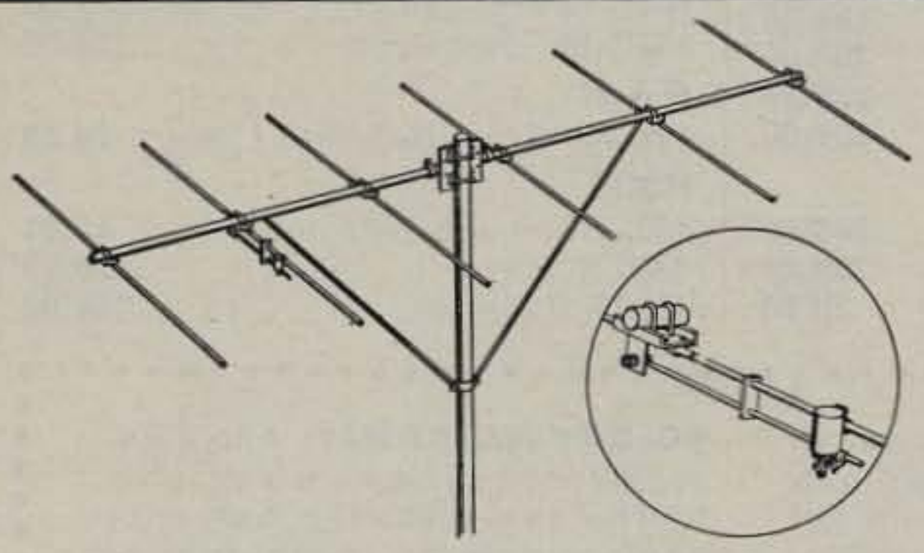

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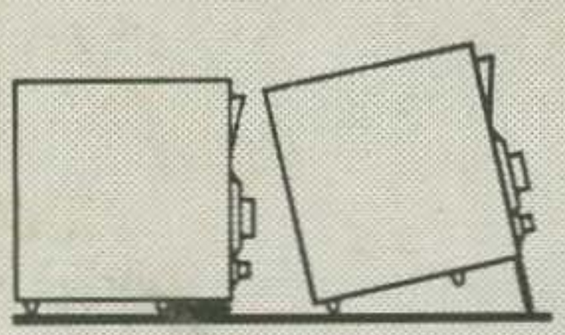

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